Occupational Outlook Handbook

Employment information on major occupations for use in guidance

1957 Edition
Bulletin No. 1215

UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS
in cooperation with
VETERANS ADMINISTRATION

/c

OCCUPATIONAL OUTLOOK HANDBOOK

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FOR USE IN GUIDANCE

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(Revision of Bulletin 998)

UNITED STATES DEPARTMENT OF LABOR
James P. Mitchell, Secretary

BUREAU OF LABOR STATISTICS
Ewan Clague, Commissioner

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This volume was prepared by the U. S. Department of Labor's Bureau of Labor Statistics with the cooperation of the following Bureaus of the Department—

Bureau of Employment Security
Robert C. Goodwin, Director

Women's Bureau
Alice K. Leopold, Director

Bureau of Apprenticeship and Training
W. C. Christensen, Director

Bureau of Labor Standards
Paul E. Gurske, Director

and the—

VETERANS ADMINISTRATION

DEPARTMENT OF AGRICULTURE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE

Foreword

The years ahead present a challenge to everyone concerned with education, guidance, and personnel work. Our growing economy creates an expanding need for skilled manpower that can be met only by enabling each individual to use his capacities to the utmost. To this end, young people need the best possible education, as well as competent guidance in selecting a career. Schools and colleges have increasing enrollments and there is an increased demand for guidance services; at the same time, there is a need for the expansion of school facilities and teaching staffs. These expansions must be planned in such a way as to prepare adequate numbers of trained workers for each of the various occupations required by the Nation's economy.

The Department of Labor is actively engaged in aiding the development of a skilled and versatile work force, and contributes to this goal in several ways. We promote the development of skills through apprenticeship and other training programs within industry. We aid the State employment services in their programs of providing placement and counseling services. Finally, we carry on research and make information available on manpower needs and employment opportunities in the various industries and occupations, so that individuals can make their career choices, and educational authorities and industry can develop their training plans, on the basis of the best possible information.

As a major part of this research and informational program, the Department is proud to present the third edition of the Occupational Outlook Handbook, which, in its earlier versions, has been so useful to guidance and personnel workers and to young people entering our labor force.

JAMES P. MITCHELL, *Secretary of Labor*

Prefatory Note

This third edition of the Occupational Outlook Handbook is being issued to replace the second edition, Bulletin No. 998, which was published in 1951.

Recognizing that people interested in choosing a career need information on the employment outlook in the Nation's occupations, the Congress in 1940 provided for the establishment of an Occupational Outlook Service in the U. S. Department of Labor's Bureau of Labor Statistics. The wide use of the first and second editions of the Handbook clearly attests the need for such information. More than 40,000 copies of the first edition were sold, and more than 45,000 of the second. Many high schools, colleges, and community agencies throughout the country rely upon the Handbook in their vocational guidance services, as do Federal and State agencies offering counseling services—including the Veterans Administration, the Department of Defense, State rehabilitation agencies, and offices of State employment services affiliated with the United States Employment Service.

In view of the rapid changes which characterize the American economy, the Congress in 1955 provided for a program of regular reappraisal of the employment outlook and for the maintenance of the Occupational Outlook Handbook and its related publications on an up-to-date basis. This action made possible the present edition of the Handbook and its subsequent biennial revision, as well as the initiation of a new periodical, The Occupational Outlook, which is being issued four times annually to provide a flow of up-to-date information between editions of the Handbook.

The third edition includes new chapters on such significant fields as the physical and biological sciences and the rapidly growing chemicals and atomic energy industries. It also embodies a reappraisal of the employment outlook in nearly all the industries and occupations described in the second edition, together with the latest available information on earnings, training, and entrance requirements in these fields of work.

The Bureau of Labor Statistics wishes to acknowledge with gratitude the cooperation of hundreds of industrial firms, unions, trade associations, and professional societies whose officials gave freely of their time in discussing employment trends in their respective fields, in supplying information, and in reviewing and commenting upon drafts of the various chapters. Contributions were made by the Women's Bureau and the Bureau of Employment Security of the U. S. Department of Labor, the Agricultural Research Service of the U. S. Department of Agriculture, and the Office of Education of the Department of Health, Education, and Welfare. The Veterans Administration has also made a major contribution to the Handbook, since much of the basic research underlying this edition was carried on over the past 12 years with the counsel and financial support of that agency.

Ewan Clague, *Commissioner of Labor Statistics*

Letter from the Veterans Administration

The need for information on employment outlook to assist veterans in choosing their vocational goals and in planning their courses of training was clearly seen by the Congress when the Vocational Rehabilitation and Education programs were established in 1943 and 1944.

Sound vocational rehabilitation and counseling practice requires that information be available on the day-to-day demands of an occupation and that these requirements be translated in terms of the counselee's capacities, abilities, interests, needs, and aspirations. It is equally important for the veteran undertaking training to see as clearly as possible the expansion or decline in employment opportunities and the factors in our economy and culture affecting the demand for varied products and services. In order to make such information available on a systematic and comprehensive basis, the Veterans Administration in 1945 initiated a program in cooperation with the Bureau of Labor Statistics of the U. S. Department of Labor, and the Bureau of Agricultural Economics of the U. S. Department of Agriculture. There is reason to believe that this program constituted the first ambitious effort at long-range forecasting in a wide variety of occupations.

As a result of this cooperation, preliminary occupational outlook releases were published in the fall of 1945 and spring of 1946. In August 1946, the first comprehensive report was released as VA Manual M7-1, Occupational Outlook Information. In 1949 and 1951, two subsequent revisions, the first and second editions of the Occupational Outlook Handbook, were issued by the Bureau of Labor Statistics, in cooperation with the Veterans Administration. The present revision is the result of further research by the Bureau of Labor Statistics which has been supported in part by the Veterans Administration.

It is gratifying that this Handbook, brought into being by the joint effort of two major governmental agencies, not only has been of substantial benefit to veterans but also has provided counselors throughout the Nation with a valuable resource in assisting other young people and adults in the choice of a career or a course of training.

H. V. Higley, *Administrator*
Veterans Administration

Letter from the Bureau of Employment Security

The Bureau of Employment Security welcomes this third edition of the Occupational Outlook Handbook. Local employment counselors of State employment services have made good use of previous editions. We are, therefore, pleased to have this expanded edition, which brings the occupational information up to date and gives local office staffs a helpful reference document regarding most of the important occupational and industrial fields in our economy.

About 8 million job seekers come to local employment service offices each year. About 850,000 of them receive employment counseling in these offices. Employment service counselors use the Occupational Outlook Handbook as an important source of national information to supplement the local, State, and national information they get through regular employment service channels. Employment service counselors also encourage counselees to read the Handbook for information that will help them in determining the extent of their interest in specific occupational fields and their possible qualifications for entering them.

Occupational choice is so wide these days that the prospective worker needs reliable and up-to-date factual information on which to base his vocational decision. We know that knowledge of the occupational opportunities is but one side of the business of selecting a life's work, though a vital one. Increasingly, people seek professional help from counselors in analyzing their own interests and abilities, and in matching these characteristics to job demands and employment possibilities. Such counseling help is available in all 1,800 local employment service offices, along with job placement, testing, and other related services. A brief description of what the USES local offices offer the job seeker appears on page 10. On behalf of the Bureau of Employment Security and its affiliated State employment security agencies, I extend to all readers of the Handbook who are making occupational choices, an invitation to go to the nearest local office of the State employment service if they desire additional information and assistance in formulating their vocational plans.

ROBERT C. GOODWIN, *Director*
Bureau of Employment Security

Letter from American Personnel and Guidance Association

Never before has the need for sound occupational information been so great. Rapidly changing career patterns and the many vacancies in the employment market are two conditions that have thrust individuals into unusual situations, whether planning careers or shifting and modifying existing career plans. The kind of occupational information that is needed includes information about occupations—authoritative, current, and realistic—and information about trends of employment in the occupations. The Occupational Outlook Handbook meets this need. The publication of the third edition is most welcome.

Counselors of youth, of the unemployed, of adults who are changing their careers, of the older workers, of various other groups depend upon the Occupational Outlook Handbook. Particularly, do they depend upon the Handbook for helping to see the future view of occupations. The Occupational Outlook Handbook is an indispensable tool for workers in guidance. In helping individuals reach vocational decisions, the counselor must have knowledge of a world of work that is complex in nature and subject to change. The counselor recognizes the impossibility of attaining an encyclopedic knowledge of occupations. He must rely on information from numerous sources in order to keep abreast of developments in the rapidly shifting work structure, and attempts to keep up to date become ever more exacting labor for the conscientious. The Occupational Outlook Handbook works for the counselor. Drawing on the countless available resources, it presents information in usable, compact form; it is the authoritative source for occupational information, including employment trends.

The counselor is indeed fortunate to have this third edition in his possession and can look forward not only to successive biennial editions but also to current outlook information through the periodical The Occupational Outlook, wall charts, bulletins, and special reports. The new Occupational Outlook program promises to furnish a product embodying the results of a continuous and systematic research program. Heartily and with pleasure I commend the Occupational Outlook Service of the Bureau of Labor Statistics for a new and improved Handbook and for a more even and current flow of occupational information.

CLIFFORD P. FROEHLICH, *President*
American Personnel and Guidance Association

Contributors

This Handbook was prepared in the Bureau of Labor Statistics, Division of Manpower and Employment Statistics under the direction of Seymour L. Wolfbein, Division Chief, and Harold Goldstein, Assistant Division Chief for Analysis.

The general planning of the Handbook was done under the direction of Helen Wood, Chief of the Branch of Occupational Outlook and Specialized Personnel, who also provided general supervision over the research program on professional, clerical, sales, service, and related occupations. Stella P. Manor assisted in the planning, reviewed the manuscripts for consistency with vocational guidance standards, and supervised the assembly of the manuscripts for publication. The research on professional, clerical, sales, service, and related occupations and the writing of these chapters were carried on under the direct supervision of Cora E. Taylor.

The research program and the writing of chapters on trades and industrial occupations and major industries were directed by Sol Swerdloff, Chief of the Branch of Skilled Manpower and Industrial Employment Studies, with the assistance of Howard Rosen. The long-range economic projection studies were carried on under the direction of Mr. Swerdloff by Murray S. Weitzman.

Members of the staff of these two branches who contributed sections were: William L. Copeland, Mannie Kupinsky, Bernard Michael, William Paschell, Pearl C. Ravner, Max A. Rutzick, Robert J. Rosenthal, James J. Treires, Bernard Yabroff, Gerard H. Cormier, Leo E. Gershenson, Annie Lefkowitz, Morton Levine, Harold S. Liebling, Rose K. Wiener, Daniel P. Willis, Jr., Vincent H. Arkell, Evelyn R. Kay, Clare Shove, Howard V. Stambler, William M. Topolsky, Marian A. Laeklen, Lorraine O'G. Jones, and Carole F. Rapp. Arthur Schatzow assisted in the review of manuscripts and assembly of the Handbook for publication. James W. Longley assisted in the long-range economic projection studies. J. Sue White, Catherine F. Delano, and Anna M. Latimer provided research assistance, checked the manuscripts for factual accuracy, and assisted in other ways.

Introductory chapters on population and employment trends were prepared under the general direction of Raymond D. Larson, Chief of the Branch of Employment and Labor Force Analysis, with the assistance of Sophia Cooper. Jacob Schiffman carried on the research and wrote the chapters.

The chapter on earnings was written by Harry M. Douty, Chief of the Bureau's Division of Wages and Industrial Relations.

Three members of the staff who left the Bureau during the preparation of the Handbook also made significant contributions. They are Richard H. Lewis, formerly Chief of the Branch of Skilled Manpower and Industrial Employment Studies, Robert W. Cain, formerly in charge of studies of scientific and technical personnel, and Theresa R. Shapiro, who contributed sections on professional occupations.

Reports on 13 occupations in which women predominate were prepared in the Women's Bureau of the U. S. Department of Labor under the general supervision of Anna Jo Behrens, Marguerite W. Zapoleon, and Winifred Helmes. The following individuals wrote the various reports: Mildred S. Barber, Jean Campbell, Agnes W. Mitchell, Nora Tucker, and Jean Wells.

The section on services to job seekers at public employment offices was prepared by the Bureau of Employment Security.

The chapters on agricultural occupations were prepared in the Farm Economics Research Division of the Agricultural Research Service, U. S. Department of Agriculture under the direction of Wylie D. Goodsell, William H. Metzler, Ronald L. Mighell, and Orlin J. Scoville, with the assistance of W. H. Brown, H. C. Fowler, A. S. Fox, R. B. Glasgow, Erling Hole, E. B. Hurd, P. R. Kulp, E. J. Smith, and J. C. Volentine; Pelagia Schultz, Information Division; Tom Gardiner, Soil Conservation Service; John Speidel and Ralph Groening, Federal Extension Service. Assistance was also given by E. C. Johnson, Farm Credit Administration; and R. E. Naugher, Office of Education, in the Department of Health, Education, and Welfare.

The Occupational Analysis Branch, Division of Placement Methods, Bureau of Employment Security, U. S. Department of Labor, gave advice and assistance particularly on matters of occupational classification and descriptions of occupations.

The photographs credited to the U. S. Department of Labor were taken by James B. Lindley of the Visual Services Section. Some photographs were supplied by various other Government agencies as shown by the credit lines accompanying the pictures. The remaining photographs were contributed by: American Dental Association; American Optical Co.; Bausch and Lomb Optical Co.; D. C. Optometric Association; American Security and Trust Co.; American Telephone and Telegraph Co.; Arizona State Board for Vocational Education; National Education Association; Bakelite Co.; Brookhaven National Laboratory; Capitol Radio Engineering Institute; CBS-Hytron; Chrysler Corp.; Ford Motor Co.; General Motors Corp. Detroit Edison Co.; Douglas Aircraft Co., Inc.; Lockheed Aircraft Corp.; North American Aviation, Inc.; North Central Airlines; United Air Lines; Dupont Chemical Co.; Jefferson Chemical Co.; Eagle Clothing Co.; The Hecht Co.; General Electric Co.; Harper Hospital, Detroit; Hickey Freeman Co.; Hilton Hotels; Mayflower Hotel; International Brotherhood of Electrical Workers; International Business Machines Corp.; Marchant Calculating Machine Co.; The New York Employing Printers Association; Ransdall Printing Co.; New York Central System; Norfolk and Western Railway; Rock Island Lines; Santa Fe Railway; Union Pacific Railroad; The Standard Oil Co. of New Jersey; The United Horological Association of America, Inc.; The U. S. Steel Corp.; Washburne Trade School; The Washington Post and Times Herald; The Willamette Iron and Steel Co.; and The Zontian of Zonta International.

Note

A great many trade associations, professional societies, unions, and other organizations in industry are in a position to supply valuable information to counselors or young people seeking information about careers. For the convenience of users of this Handbook, the reports on occupations or industries list organizations or publications which may be able to provide further information. While these references were assembled with care, the Bureau of Labor Statistics has no authority or facilities for investigating organizations. Also, since the Bureau has no way of knowing in advance what information or publications each organization may send in answer to a request, the Bureau cannot evaluate the accuracy of such information. *The listing of an organization, therefore, does not in any way constitute an endorsement or recommendation by the Bureau or the Department of Labor, either of the organization and its activities or of the information it may supply.* Such information as each organization may issue is, of course, sent out on its own responsibility.

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Points to Keep in Mind When Using the Handbook

This book answers many questions people ask when they are interested in choosing an occupation. It gives information on more than 500 occupations and industries—on the employment outlook in each of these fields, the nature of the work, training, and other qualifications needed for entry, lines of advancement, where jobs are located, and earnings and working conditions. To find out how the book is arranged and how to interpret the information, see Guide to the Handbook (beginning on page 3).

What To Bear in Mind About Employment Outlook Statements

All conclusions about the economic future necessarily rest on certain assumptions. The statements on the employment outlook in this book assume that: (1) there will not be a war; (2) the defense program will be continued at about the same level as in early 1957; and (3) the general level of business activity will remain high and unemployment low in the United States. Under other circumstances, the employment situation would, of course, be changed—in ways indicated in the statements on the occupations likely to be most affected.

Where To Go for Local Information

The picture of employment opportunities given in this book applies to the country as a whole, unless otherwise indicated. People who want supplementary information on job opportunities in their community should consult local sources of information, particularly the offices of State employment services affiliated with the U. S. Employment Service. For suggestions as to other local sources, see page 10.

How To Keep Up To Date on Occupational Outlook

This Handbook contains the most recent information available when the book was prepared in late 1956 and early 1957. To keep readers up to date on new developments affecting the employment outlook and on changes in earnings and other items, the Bureau of Labor Statistics publishes a periodical, The Occupational Outlook, four times each year. To find out about this publication and how to order it, see Other Publications Useful to Counselors at the back of the Handbook.

What Other Information Is Needed

A career decision means matching a person and an occupation. Information on occupations and the employment opportunities they offer is only part of that needed in this process. The other part relates to the potential worker himself—his interests and aptitudes. People can obtain help in assessing their own abilities and interests and in selecting the occupations for which they are the best suited from vocational counselors in schools and colleges, State employment service offices, Veterans Administration regional offices and guidance centers, and many community agencies.

OCCUPATIONAL OUTLOOK HANDBOOK

Putting the Handbook to Work

Counselors, teachers, guidance supervisors, and counselor trainers will welcome this revision of the Occupational Outlook Handbook as an essential tool in carrying out one very important area of their work. As the name implies, the Handbook deals with and interprets trends in occupations. Basically, it is not a text in occupations, nor does it attempt to delineate methods for use in disseminating the storehouse of information which it contains. Rather, it provides fundamental information about job situations and future outlook which users can apply to the full advantage of individuals as they make career choices.

The last edition appropriately placed emphasis upon the relative and often transitory nature of much occupational information, and indicated the need for those who use the Handbook to exercise caution in making unqualified statements about the characteristics of and opportunities in a particular job field. Developments some 5 years later have heightened the necessity for this warning. The impact of automation as it increases job opportunities for technically trained workers, the ebb and flow of prosperity and depression, shifts in industry from region to region, and the changing demands for luxury and "bread-and-butter" items—all these factors have made persons who assist youth in career decisionmaking fully aware of the most puzzling, if not hazardous, aspect of dealing with occupational data, i. e., the fluctuant nature of the information available.

Professionally trained people who utilize the Handbook will interpret its content in the light of industrial developments and shifting economic conditions within local areas, specific regions, and throughout the Nation. Constant study of economic developments and the utilization of information from all sources, particularly local and regional employment offices, will provide valuable supplementary data in aiding individuals to make occupational decisions.

For these and other reasons, the Handbook fills a real need in assisting counselors to pinpoint trends and to make interpretations which will aid youth materially in structuring consistent and realistic plans for the future. While the Handbook provides data on national trends, counselors and other professional people will be careful to use these data in the light of information upon specific conditions in local areas.

Use by Teachers of Occupations

A teacher of occupations will find that the general plan of the Handbook makes it possible to provide an overview of the major occupational groups and the dominant trends in particular occupations. Fortunately, the specifics regarding trends and outlook are also available so that the Handbook serves the purpose of aiding the teacher of occupations in providing students with both general and specific information related to an area of work. The teacher, no doubt, will wish to secure information about local and regional trends through such resources as the school counselor and other agencies within the community. Since the occupations teacher fully realizes the fluctuant nature of occupational information, he will impress upon students the necessity of including all local findings in any study of a particular area of work.

Use by Counselees

The Handbook makes its leading contribution to the counselee as he sets up a design of long-term plans. At this stage in his high school career, the student is forced to project his thinking and make some long-term decisions. He must be able to determine the types of professional preparation required if his occupational aspirations

indicate the need for such training. If his proposed occupation requires professional preparation, he should have information on internships required and their availability. If his interests point toward technical training, he should explore apprenticeship requirements, the value of formal courses, and the extent to which on-the-job training supplements, or in some instances supplants, formalized training. In this kind of setting, the national data are most helpful in answering questions and in assisting the student to determine whether he will be confronted with the need to make a change in geographical location to secure employment in his chosen field. The Handbook figures will prove valuable in providing clues for determining the regional location of greatest demand for individuals with the skills he aims to acquire. While most students in high school may be able to make use of the Handbook, the teacher of occupations and the counselor can aid them in simplifying and interpreting the facts of pertinence to their long-range planning.

Use by Counselors

The counselor, perhaps, will find the greatest number of uses for the Handbook. During this period of manpower shortages in certain key occupations, the information provided will aid the counselor in assisting the counselee to evaluate the pressures for recruitment into various occupational groups, and to weigh these in the light of actual needs and realistic planning. Decisions can then be made, in the light of the opportunities available, to utilize fully the skills and aptitudes of the counselee. While most counselors have had some nonteaching work experience, it is unfair to assume that they possess detailed and accurate information on a large number of the jobs described in the Handbook. Therefore, the volume is a valuable tool in supplementing the occupational information which the counselor already has available from his experience, his knowledge of the work world, and his more intensive study of particular occupational fields.

Use by Counselor Trainers

The tentative nature of information about occupations, together with the fact that numerous changes mentioned earlier materially affect job opportunities and trends, make the counselor trainer's course on occupational information a most difficult one to teach realistically. By utilizing the Handbook, the counselor trainer has at his disposal an arsenal of facts which will enable him to increase the proficiency of the counselor-in-training in a field which requires constant reevaluation and reorientation. By concentrating on how to use the facts available, rather than amassing information on a few occupations, the prospective counselor is placed in a position to organize the information needed for counseling his students more effectively and more beneficially. In this connection, it is scarely necessary to say that many of the books furnishing occupational facts become obsolete almost as soon as they are printed. By emphasizing the procedure of studying an occupation by use of the Handbook and other relevant information, the counselor trainer provides the counselor with valuable techniques which do not become obsolete as economic conditions change.

Use in Gathering Information on Occupations

Many factors in the dynamic economy found in the United States contribute to a confusing pattern of job possibilities as teachers of occupations, counselors, or counselor trainers aid individuals in gathering pertinent information upon occupational opportunities. These can best be integrated if the resources of the Handbook are utilized to aid individuals in the analysis and interpretation of facts available through the Handbook. While the national scene is more stable than local and regional situations, users of the Handbook will find that local figures become meaningful only as national facts are applied to any one local setting. Gathering facts pertaining to occupations is a challenging process which is essential if students are to find helpful and significant assistance as they make occupational choices.

FRANK L. SIEVERS, *Chief,*
Guidance and Student Personnel Section,
Office of Education, U. S. Department
of Health, Education, and Welfare

Guide to the Handbook

Every year more than 1½ million young people enter the labor force. To provide these boys and girls with the occupational information they need to make a wise vocational choice is a matter of obvious importance both to their life adjustment and to the effective utilization of the Nation's manpower resources. For this reason, the President's Advisory Committee on Education recommended, in 1938, that an Occupational Outlook Service be set up in the U. S. Department of Labor's Bureau of Labor Statistics, to study the employment outlook in the country's major occupations and prepare reports for use in vocational guidance. The Service was organized in 1940, but during World War II devoted its resources to manpower studies needed in connection with the war effort. Immediately after the war, the Bureau started the program of occupational outlook research which led, in 1949, to the publication of the first edition of the Occupational Outlook Handbook. A second edition appeared in 1951.

This third edition of the Handbook summarizes the results of more than a decade of research, and particularly of recent studies of the employment trends and long-range outlook in more than 500 occupations. The reports on different fields of work, which make up the major part of the book, present the conclusions reached on employment outlook, together with information on a number of other topics of importance in vocational guidance—for example, the nature of the work done in each occupation, the training and other qualifications needed for employment, and earnings and working conditions.

Contents of Handbook

Introductory Chapters

Before using the reports on different fields of work, it is important to read the Guide to the Handbook, which forms the present chapter. Besides describing the content and organization of the Handbook, this chapter tells how the information was obtained and discusses a number of points which need to be borne in mind in interpreting the occupational outlook statements.

The chapter following this one contains suggestions regarding supplementary sources of information and describes how readers can keep up to date on developments affecting the occupational outlook—a highly important matter in view of the constant changes characteristic of the American labor market. A brief description is given also of the counseling, placement, and other services available to job seekers at public employment offices. In choosing a field of work, young people not only need information of the kind given in the Handbook but also require help in interpreting these data in the light of their own aptitudes and interests. Counselors in high schools and colleges provide such assistance to great numbers of students; regional offices and guidance centers of the Veterans Administration offer like services to many veterans; and counseling services are offered by many community agencies. The local offices of State Employment Services affiliated with the U. S. Employment Service are of special importance as a source of advice and assistance for workers seeking employment.

Subsequent chapters describe the main trends in the population, labor force, industries, and occupations of the United States and discuss the earnings of American workers. These chapters are designed to provide counselors with background information which will add perspective to the reports on individual fields of work. They should also be useful references for classes on occupations and for students and other individuals interested in obtaining a general view of the world of work.

Reports on Major Occupations and Industries

The reports on different fields of work follow the introductory chapters just mentioned. These reports are arranged in chapters dealing with groups of related occupations or with occupations

within specific industries, and these chapters are, in turn, grouped into six major divisions of the book. The first three divisions cover occupations that are found in many industries and can best be discussed outside the context of a particular industry. They deal, respectively, with professional, administrative, and related occupations; with clerical, sales, and service occupations; and with skilled trades and other industrial occupations. The last three divisions of the Handbook discuss occupations in a number of the country's major industries, in agriculture, and in government.

Even in a book as large as this one, it is obviously impossible to present information on all of the many thousands of occupations in which American workers are employed. The occupations selected for discussion include those reported to be of greatest interest to school and college students, veterans, and other young people requesting guidance. Most of them require relatively long periods of formal education or on-the-job training; the need for long-range outlook information is most acute in connection with the choice of careers in such occupations. Another criterion used in deciding which occupations to cover was their relative size and the number of employment opportunities they offer. Some smaller fields have been included, however, either because there is special interest in them or because reports regarding them could be prepared readily in connection with studies of major occupations in the same industry.

Altogether, the more than 500 occupations discussed in the Handbook employ about 85 percent of all workers in professional and related occupations; 80 percent of those in skilled occupations; 50 percent in clerical occupations; 45 percent in service occupations; and smaller proportions in administrative, sales, and semiskilled occupations. They also include the main types of farming. Furthermore, each division of the Handbook has an introduction which briefly describes the chief occupations and employment trends in the broad field of work with which that division of the book is concerned. These introductions contain background data designed to aid the reader in interpreting the reports on different occupations; they also provide some general information on many fields of work which could not be covered in the occupational reports. The Handbook may, therefore, serve as a guide to the bewildering array of occupations in the United States, besides providing specific information on a large number of occupations of interest to students, veterans, and other persons planning to undertake prolonged training.

Indexes

To assist readers in locating information on the occupations in which they are interested, a list of the occupational reports is provided following the table of contents. Persons desiring information on occupations related to a general field of work—for example, artistic, technical, managerial, clerical, or manipulative work—may refer to the Index to Occupations Classified by Broad Fields of Work (the first of the two indexes at the back of the book). Finally, an alphabetical index to occupations is provided for ready reference.

The Occupational Reports

Subjects Covered and Sources of Information

Young people in the process of choosing a career need many different kinds of occupational information to aid them in this choice. They need to know, for example, what the work is like in various occupations, where the jobs are located, how much training is required to enter each field, and whether the field is likely to offer good opportunities for employment when they complete their training.

An outline of the topics which should be covered in occupational monographs has been prepared by the National Vocational Guidance Association on the basis of its members' experience in vocational counseling. This outline served as a guide to the Bureau of Labor Statistics in determining the subjects which should be covered in the occupational reports. Although it was not possible to discuss all the suggested topics in detail, the occupational reports contain some data on all major items listed in the NVGA outline which were considered relevant to the occupation under discussion. The subjects covered include: nature of the work, the number of workers in the occupation, employment of women, types of employers,

geographic location of employment, training and other qualifications needed, lines of advancement, employment trends and outlook, earnings and working conditions, and where to go for more information. In addition, the chapters on the occupations in particular industries include brief descriptions of the goods or services produced by the given industry and of its operations and organization.

In order to obtain information on this variety of topics for the hundreds of widely different occupations discussed in the Handbook, it was necessary to draw upon many different sources. In describing the nature of the work done, for example, the sources looked to first were the Dictionary of Occupational Titles compiled by the U. S. Employment Service, other job descriptions prepared by that agency and affiliated State Employment Services, and job descriptions used by the Bureau of Labor Statistics in connection with its wage statistics program. In addition, occupational descriptions prepared by the U. S. Civil Service Commission, professional societies, trade associations, and other governmental and private organizations were utilized extensively. The information on training and other qualifications needed for employment came from an equal variety of sources—including the U. S. Department of Labor's Bureau of Apprenticeship and Training, State Employment Service offices, State licensing boards, trade unions, trade associations, individual employers, professional societies, and college placement agencies.

To indicate where the occupations discussed fit into the classification system of the Dictionary of Occupational Titles, "D. O. T." numbers are given wherever possible, following the titles of the occupations discussed. By reference to part II of the dictionary, which contains a listing of occupations in order of their D. O. T. numbers, one can find out in which broad occupational group an occupation falls—for example, whether it is a professional, clerical, service, or skilled occupation—and also determine its classification on a much more exact basis. (For a description of the D. O. T. classification system, see introduction to Index I—Occupations Classified by Broad Fields of Work.)

The sections on employment outlook in the occupational reports present conclusions based not only on compilation of information from many sources but also on extensive economic and statistical analysis. Both the sources and the analytical methods used in studying the employment outlook are described in the following section, along with some qualifications which the reader should bear in mind in interpreting the outlook data.

The information presented on earnings and working conditions represents the most recent available when the Handbook was prepared for the printer early in 1957. A large part of the data came from Bureau of Labor Statistics surveys of wages, other employment benefits, and industrial hazards and from the Bureau's studies of trade union agreements. Here again, however, many different sources of information had to be utilized—including surveys of the earnings of professional personnel made by the National Science Foundation and professional societies, and information from the U. S. Civil Service Commission on salaries of Federal employees. Because of the variety of sources used, the figures presented in the different occupational statements refer to different periods of time, cover varying geographic areas, represent different kinds of statistical measures, and have varying degrees of accuracy. Comparisons between the earnings data for different occupations should, therefore, be made with great caution. However, a general picture of earnings in the United States is given in the chapter on Earnings From Work. The information there presented should be a useful frame of reference in interpreting the earnings data for a particular field of work.

The occupational reports could not have been completed in their present form without the assistance received from a great number of companies, trade associations, trade unions, professional societies, colleges and universities, and government agencies. Officials of these organizations generously made available much unpublished as well as published material and supplied a great deal of helpful information through interviews. Furthermore, they reviewed preliminary drafts of all the occupational reports. The information and conclusions presented in each report thus reflect the knowledge and judgment not only of the Bureau of Labor Statistics staff but also of leaders in the field discussed, although the Bureau, of course, takes full responsibility for all statements made.

How Employment Outlook Conclusions Were Reached and How to Interpret Them

In providing employment outlook information which will influence career decisions, it is necessary to look ahead at least several years and, if possible, several decades. The emphasis in the employment outlook sections of the Handbook is, therefore, on long-run employment prospects, although information has been included also on the employment situation in many fields of work in 1956, when the reports were prepared, and on the opportunities to be expected in the next few years.

Since the Handbook is designed primarily for use by high school students and their counselors, the employment outlook information is presented in nontechnical language. Some indication is given of the general factors considered in arriving at the conclusions stated, but no attempt is made to describe fully the economic and statistical analysis underlying them.

In these studies of the employment outlook, as in all other appraisals of the economic future, it has been necessary to make certain assumptions as to the general economic and political environment in the country. A catastrophe such as a war or a severe economic depression would, of course, create an employment situation entirely different from that likely to develop under more favorable circumstances. Young people can not build their lifetime plans in expectation of such unpredictable catastrophes, however. In this Handbook, it is, therefore, assumed that the general level of business activity will remain high and unemployment low, that the country will remain at peace; and also that it will continue to have a defense program of about the same size as in 1956. For practical purposes in vocational guidance, these assumptions are believed to provide the most useful framework for analysis. To avoid constant repetition, the assumptions are seldom mentioned in the reports on fields of work which would probably be affected by a general decline in business or a change in the scale of mobilization to about the same degree as the economy as a whole. On the other hand, in the statements on occupations where employment tends either to be unusually stable or to be subject to marked ups and downs, these facts are indicated. Even in the latter occupations, however, long-term trends in employment are more important than short-run fluctuations in appraising the outlook in connection with an individual's choice of a lifetime career.

Since the factors which determine the demand for workers and the available supply differ greatly from one occupation to another, the sources and methods used in the various employment outlook studies necessarily differed also. Certain general patterns of research were followed, however.

The starting point in many studies was an analysis of past and prospective population trends, including the changes expected in population of school and college age, in numbers of older people, in employment of women, and in the concentration of population in and around cities. In fields such as teaching, the health professions, and many personal services, population factors have a direct and obvious influence on employment opportunities. They are also of great importance in many industries—for example, residential construction, telephone communications, men's clothing, and retail trade.

Changes in the volume of business and employment in each industry are brought about, however, by many factors besides the population—for example, by shifts in consumer preference from one type of product or service to another, by the development of new products which cut into the market for old ones, by the general rise in income levels which makes it possible for people to afford more expensive items, and by technological developments affecting production methods and raw materials used. In studying the outlook in a particular industry, the factors having the greatest influence in that industry were analyzed and projections were made of demand for the industry's products or services. These projections were then translated into estimates of the numbers and kinds of workers that would be required to produce the indicated amounts of products or services—in view of the relative numbers currently employed in different occupations, productivity trends, probable further reductions in the workweek, and other factors. Past trends in employment were also given much weight in arriving at the conclusions as to probable future employment trends.

To assist in carrying through this analysis and ensure that the assumptions made in the different occupational studies were consistent, overall projections of the economy over the next two decades

were developed. This general analytical framework included projections of the population, labor force, gross national product, average hours of work, employment in major industries, and related economic measures, by 5-year intervals up to 1975. In all studies of separate occupations and industries, the employment projections were tied in with those derived from the projections of the entire economy.

The decennial Censuses of Population and the monthly Current Population Surveys conducted by the Bureau of the Census provided the basic data on population and labor force trends, both for the overall projections and for the studies of individual occupations and industries. The analysis and intepretation of these data stemmed from the Bureau of Labor Statistics' continuing program of labor force studies.

Equally indispensable to the studies of employment trends in major industries were the statistics on employment in nonagricultural establishments compiled by the Bureau of Labor Statistics. Each month, the Bureau prepares estimates of employment, hours of work, earnings, and labor turnover based on reports from about 155,000 establishments. Estimates are available for a great number of different industries, for the past quarter century or more.

Another Bureau program which contributed to the analysis of future employment trends was its studies of productivity and technological developments. Anticipated productivity trends and technological changes were allowed for in converting the projections of demand for the products of a given industry into estimates of the numbers of workers who will be needed in that industry.

Information on the magnitude of industrial research programs and on the employment of scientists and engineers in research and other activities from surveys conducted by the Bureau in cooperation with the National Science Foundation and other agencies has been extensively utilized in studying the scientific and engineering professions. The findings with regard to the scale and trend of industrial research activities have contributed also to the analysis of employment prospects in many science-based industries.

Still another Bureau project which played a major role in the development of estimates of future employment requirements in different occupations is the Occupational-Industry Matrix. The matrix consists of a set of tables for 159 industry sectors which represent the entire economy of the United States. For each industry sector, the tables show a percentage distribution of employment among about 150 of the most important occupations and also among the major occupational groups. The matrix was valuable in appraising the effects of changing employment levels in different industries on employment in specified occupations. It was also useful in estimating the numbers of workers currently employed in each occupation. This was an important function, since for many occupations the 1950 Census of Population was the most recent source of basic data on employment, and for many others only fragmentary data were available which had to be integrated by means of the matrix in order to derive overall estimates of employment.

By bringing together and analyzing information from these many sources, conclusions have been reached as to prospective employment trends in the occupations covered by this Handbook. In general, increases in employment and, hence, openings for new workers are anticipated. However, the expected gains in employment are by no means an adequate indication of the total numbers of job openings which will need to be filled. In most occupations, more workers are needed yearly to fill positions left vacant by those who leave the occupation (to enter other occupations or because of retirement or death) than are needed to staff new positions created by growth of the field. Rarely do occupations grow fast enough so that the reverse is true. Even occupations which are declining in size may offer employment opportunities to many young people.

The number of openings likely to arise in an occupation owing to deaths and retirements may be estimated by reference to the Tables on Working Life developed by the Bureau of Labor Statistics for both men and women. The tables are similar to the actuarial life tables used by insurance companies as a basis for their premium and benefit rates.

The value of the tables in assessing employment opportunities is illustrated by a comparison of two skilled occupations—painter (in construction and maintenance) and automobile mechanic. Painters have a higher average age—and, therefore, a higher rate of deaths and retirements—than do automobile mechanics; about 2.4 percent of all painters retire or die every year, compared with only about 1.1 percent of all automobile me-

chanics. The difference between these two rates is so great that, even though the total number of automobile mechanics employed is much larger than the number of painters (643,000 compared with 390,000 in 1950), many more new workers are needed each year to fill vacancies in painting than in auto repair jobs.

In most occupations where men comprise the great majority of workers, as they do in the trades just referred to, the death and retirement rate is generally between 1 and 4 percent. However, the rate is usually somewhat higher in women's occupations, because so many women "retire" to get married or assume family responsibilities. The replacement rate among stenographers, typists, and secretaries, for example, is at least 6 percent a year.

Besides vacancies due to deaths and retirements, many openings arise owing to transfers of workers from one occupation to another. The Bureau of Labor Statistics has made studies of the occupational mobility of scientists and of several groups of skilled workers (molders, electronic technicians, and tool and die makers). However, information on the movement of workers among occupations is still limited, and further studies are needed to indicate the full effect of this mobility on employment opportunities.

The types of information mentioned so far in this section all relate to the demand for workers. In order to appraise the prospective employment opportunities in an occupation, it is important to have information also on the probable future supply of personnel. The statistics on high school and college enrollments and graduations compiled by the U. S. Office of Education are the chief source of information on the potential supply of personnel in the professions and other occupations requiring extensive formal education. Data on numbers of apprentices from the Bureau of Apprenticeship and Training provide some information on new entrants into skilled trades.

Many of the statistical sources and analytical approaches listed in preceding paragraphs did not exist, or existed in much more limited form, when the first precursor of this Handbook was prepared for the Veterans Administration in 1946. The intervening decade has seen great progress both in compiling the basic data needed for analysis and projections of future trends affecting the employment outlook and in the development of analytical techniques. The reader should bear in mind, however, that the art of economic forecasting is still in an early stage of development and that it is, at best, fraught with difficulty and uncertainty. It is necessary to keep in mind also the basic assumptions underlying the forecasts—continuance of generally high levels of economic activity and the absence of large-scale war. The Bureau believes that, within this general framework of assumptions, the basic trends affecting employment can be discerned with sufficient accuracy to meet the needs of young people preparing for careers. Furthermore, since these trends change from time to time and information on earnings and related subjects becomes out of date quickly, provision has been made for review of the reports at frequent intervals. It is planned to make the results of this review available through biennial editions of the Occupational Outlook Handbook and through a periodical publication, The Occupational Outlook (described in the next chapter).

Where To Go for More Information or Assistance

Young people using this Handbook may wish to supplement the information in a number of different respects. They may, for example, desire information on occupations which could not be covered in the occupational reports. They may also wish more detailed information on the nature of an occupation, training requirements, or other subjects than could be included in these condensed reports. Furthermore, they will often need information on the situation in particular localities, to add to the nationwide picture presented in this book.

Suggestions as to sources of additional information on the fields of work discussed are contained in each of the occupational reports. In general, the references given are limited to publications prepared by government agencies and to the names and addresses of professional societies, trade associations, trade unions, and government agencies having special knowledge of the given fields. For suggestions as to other publications which might be consulted, the reader is referred to the several books and current indexes which list the great numbers of pamphlets, books, and monographs published on different occupations. These bibliographies, available in many libraries, may be useful also in locating material on occupations not covered in the Handbook.

The information on employment outlook, training requirements, earnings, and related subjects given in the occupational reports summarizes the situation in the United States as a whole. To find out about current job opportunities, hiring standards, or earnings in a particular community, it is necessary to check with local sources.

In communities where there is a local office of the State Employment Service, this is one of the best places to obtain such information. The services available in these offices are described on page 10 of this chapter.

There are also many other possible sources of local information on occupations. The best source of information on a profession may often be the local branch of a professional society, such as the American Medical Association, American Bar Association, or American Chemical Society. Similarly, the local offices of trade unions will usually have information on the occupations in which their members are employed. It is also possible to seek information directly from employers in the industry or business in which one is interested; lists of firms classified by industry can be obtained through the local Chamber of Commerce or from the classified section of the telephone directory. Other sources of information on opportunities in some localities are the special community occupational surveys made by some school systems and other organizations.

For published information as to the occupations and industries which offer employment opportunities in each State and in or near each large city, one may refer to the reports in the Occupations and Industries Regional Series prepared by the Bureau of Labor Statistics for the Veterans Administration (listed at the back of the Handbook). The facts contained regarding the fields of work in which men and women are employed in different communities are important in vocational guidance, for two reasons—the great variation among communities in the types of jobs available and the fact that many young people prefer occupations in which there are local opportunities for employment.

Information on earnings and working conditions in important occupations is available for a number of major labor market areas from another series of reports prepared by the Bureau of Labor Statistics. These reports, called Occupational Wage Surveys, provide the following kinds of information wherever possible: the numbers of workers in selected occupations in major industries, average earnings in these occupations, and job descriptions. In addition, wage rates and weekly working hours are reported for some groups of workers in office-clerical jobs, professional and technical occupations, skilled maintenance work, and less skilled occupations. The reports also show prevailing local practices in regard to pensions, vacations, holidays, and sick leave. A list of the Occupational Wage Surveys available may be obtained from the Bureau of Labor Statistics, U. S. Department of Labor, Washington 25, D. C.

Keeping Up to Date on Occupational Outlook

The occupational outlook program of the Bureau of Labor Statistics is designed to keep readers constantly up to date on occupational outlook information.

The core of this program is the Occupational Outlook Handbook. It is planned to issue revised editions every 2 years hereafter. Each new edition will involve a thorough review of all information presented and will incorporate revisions wherever needed. Futhermore, the Bureau's continuing research program should make it possible, with each new edition, to extend the coverage of occupations in the Handbook. It is planned to issue all editions both in bound form and in the form of a series of reprints relating to different fields of work—to meet the expressed need both for a single reference volume and for separate reports which can be filed by industry or occupation and utilized by students interested in particular fields of work.

To keep readers up to date between editions of the Handbook on developments affecting employment opportunities and on the results of new occupational outlook research, a new periodical, The Occupational Outlook, is being issued four times yearly during the months schools are in session. The Occupational Outlook will be the same size as the Handbook and each issue will include a cumulative index to all issues since the latest Handbook. Whenever an article in the periodical supplements or supersedes information presented in the Handbook, a statement will be made to this effect, with a reference to the relevant page of the Handbook, and the article will be arranged so that it can be detached and inserted in the Handbook if desired. When a new edition of the Handbook is published, it will incorporate the information contained in recent issues of the periodical.

Besides these two publications, occupational outlook bulletins will be issued at irregular intervals. These bulletins will contain much more detailed information on the outlook in various fields of work than can be included either in the Handbook or in the periodical. They will be summarized in articles in The Occupational Outlook.

Thus, the reader can locate easily and quickly all up-to-date information published by the Occupational Outlook Service on the fields of work in which he is interested. He can do this by checking in only two places—the alphabetical index in the latest edition of the Handbook and the cumulative index in the latest issue of The Occupational Outlook.

Directions for ordering the different Occupational Outlook publications will be found at the back of the Handbook. In addition, the Bureau will be glad to place any user of this Handbook on its mailing list to receive announcements of new publications and current releases summarizing the results of new studies. Anyone wishing to receive such materials should send the request to the Bureau of Labor Statistics, United States Department of Labor, Washington 25, D. C. Please include postal zone numbers in the address.

Services to Job Seekers at Public Employment Offices*

Many of the readers of this Handbook want assistance in choosing a suitable type of work and in finding the right job. The reader who wants professional assistance from trained counselors and help in obtaining the right job should know about the services offered by his local public employment office.

The U. S. Employment Service and affiliated State Employment Services form a nationwide organization which plays an important part in our economy. Through 1,800 local offices, conveniently located in cities and towns throughout the United States, this employment service finds jobs for workers and workers for jobs.

Although the Employment Service is a Federal-State system, each employment office is basically a local community organization. It is concerned with facilitating suitable and stable employment for the community's working population and with adequately meeting the manpower needs of its employers. And because of this concern, the local office tries to do more than simply refer a worker to a job—it tries to match the worker and job so that the requirements of each are satisfied. To do this, the public employment office has developed a number of services that are available to all job

*Prepared by the Bureau of Employment Security, U. S. Department of Labor.

seekers. Many of them are particularly important to young men and women about to enter the world of work.

Counseling Services

Employment Service counseling assists people in choosing a suitable field of work—both young people leaving school and experienced workers who wish or need to change their field of work.

The major purposes of employment counseling are to help people to gain insight into their actual or potential abilities, their interests, and their personal traits; to understand something of the nature of the world of work; and to make the best use of their capacities and preferences in the light of available job opportunities.

In the Employment Service, the counselor has at his fingertips a vast store of resources, including testing facilities and labor market and occupational information.

Testing. Most local offices provide testing services, including the General Aptitude Test Battery, which measures basic abilities for many and varied broad fields of work and for more than 500 specific jobs within these fields. These tests help the applicant appraise his abilities. They may reveal aptitudes the job seeker did not know he had.

Labor Market Information. The State employment office counselor has information about jobs in the community. He knows what kinds of jobs prevail in local industry, which jobs are more plentiful, what the hiring requirements and the opportunities for promotion are, and what the jobs pay. In addition, since his office is a part of the nationwide employment service, it has information regarding employment opportunities in other areas all over the country.

Occupational Information. The Employment Service office has occupational information which helps the job applicant decide whether he is suited to a particular kind of work. The Dictionary of Occupational Titles, Job Descriptions, and the other tools describe the work performed in the various occupations and the training required, lines of advancement, physical demands, and working conditions for most occupations.

Cooperative Arrangements with Other Community Groups. Local employment office counselors work closely with other public and private agencies and organizations which provide special services that the job seeker may need in order to become better prepared for employment. These groups include educational, training, vocational rehabilitation, and health and welfare agencies.

Placement Assistance

The primary objectives of the placement service in the local employment office are to fill employers' job openings with occupationally qualified workers and to locate employment for workers (including claimants for unemployment insurance) which is suited to their skills, knowledge, and abilities. The employment office placement service is designed to eliminate the waste of "hit-or-miss" job hunting.

Local Openings. State employment office personnel maintain regular contacts with local employers and know their hiring needs and their jobs. Placement interviewers receive requests from employers for all kinds of workers. Through the local office, therefore, the job applicant has access to a variety of job vacancies with many employers, just as the employer has access to many applicants. When no suitable job exists for an individual worker, the employment service may attempt to solicit an opening for him from likely employers.

Jobs Throughout the Country. The job clearance system of the nationwide network of State employment offices offers the applicant an opportunity to qualify for jobs outside his area, elsewhere in the State and the Nation, and even in foreign countries. Each State Employment Service prepares frequent inventories of hard-to-fill jobs which are distributed to all other State Employment Services. This makes it possible for them to refer local workers to out-of-area jobs for which they qualify.

Placement Aids. As in counseling, the information on local job opportunities for industries, occupations, and areas, and occupational requirements which is available in the employment offices contributes greatly to getting the right job for the worker and the right worker for the job.

Also available to the job seeker are aptitude and proficiency tests which help determine whether an applicant is qualified to perform satisfactorily on specific jobs.

Services to Special Worker Groups

The Employment Service has developed techniques and procedures for particular applicant groups who may encounter special problems in their search for suitable jobs.

Special services to youths include emphasis on counseling graduating students and school dropouts, and intensive efforts to promote employment opportunities for them. In many cities, employment service offices have cooperative arrangements with high schools to provide counseling, testing, occupational information, and placement services to students prior to their graduation as well as to other school leavers.

The State employment offices have long maintained an active program for helping applicants with vocational handicaps. The emphasis is on what these people can do with their abilities rather than on what they cannot do because of a disability.

The Employment Service provides special services for veterans. In each local office there is a veterans' representative who is trained to know veterans' rights and benefits and who carries on job promotion for veterans. In order to speed their readjustment to civilian life, the State Employment Services provide information service to veterans at military separation and transfer points.

The Employment Service also has developed techniques to deal with job problems of middle-age and older workers. Special attention is being given to assisting them to make realistic job choices. Employers have been encouraged to remove age hiring restrictions and to hire only according to the qualifications of the individual.

Similar attention is also being given to job problems of members of minority groups and others facing special difficulties in obtaining suitable employment.

How To Locate the Local Employment Office

The addresses and telephone numbers of local offices of State Employment Services affiliated with the U. S. Employment Service may be found in local telephone directories. Job seekers, employers, schools, and public and private agencies aiding clients to find employment are invited to utilize the services of the public employment offices in their communities and to avail themselves of the fund of job information maintained in these offices.

Economic and Occupational Trends

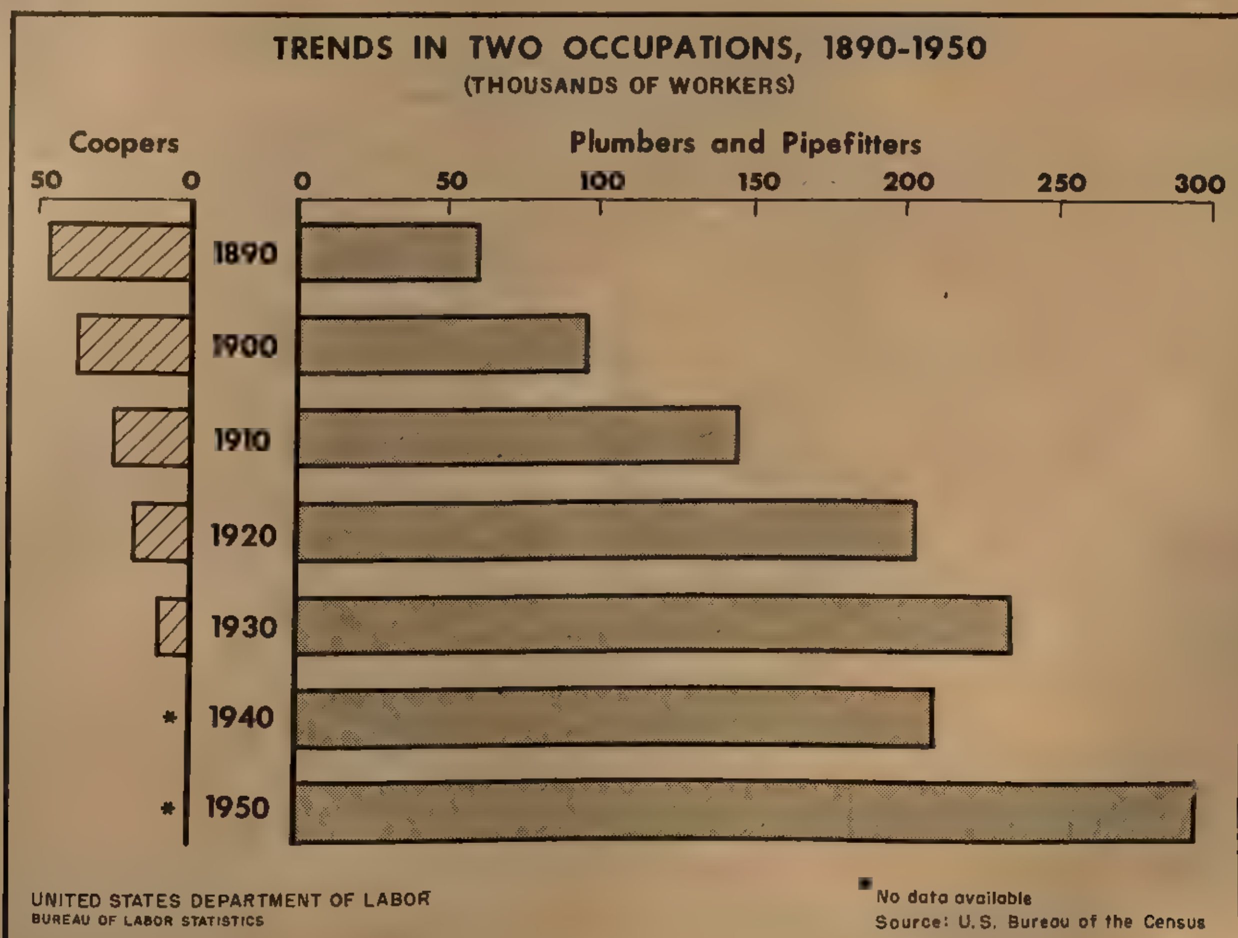
To the student learning about occupations, to the counselor engaged in explaining their intricacies, or to the person seeking information on which to base his selection of a course of training or a career, it is important to understand the rapidly changing nature of our economic life.

Constant change is the most significant aspect of the occupational and industrial world in which we live. Technological, industrial, and social changes increase the need for workers in some occupations, reduce the demand in others, sometimes create new occupations and throw old ones into the discard, and continuously alter the content and character of every line of work.

The rapidity with which the occupational picture changes is illustrated in chart 1. In 1890, a young man may have considered the choice between apprenticing himself to a cooper or to a plumber. The occupation of cooper was a well-established skilled trade while that of plumber was relatively new. Yet, within a 60-year period, the number of workers who made their living as plumbers or pipefitters increased almost fivefold, while employment opportunities for coopers shrank to a small fraction of their previous number.

What happened? With growth in population, a shift of population from farms to cities, and increases in average income, the demand for houses with plumbing conveniences grew apace. Increasing numbers of plumbers were needed to install pipes and plumbing fixtures in new houses

CHART 1



and to repair or modernize plumbing in older dwellings. Industrial and commercial expansion also created a growing demand for plumbing and pipefitting work in office buildings and industrial plants. On the other hand, the occupation of cooper declined as wooden barrels were displaced for various uses by other types of containers, and as factory methods were introduced in making the wooden barrels still needed for certain uses.

Thus, one occupation grew tremendously, while the other declined rapidly, because of population growth, improvements in living standards, industrial growth, and technological changes.

To young people looking forward to a lifetime of work—and that means nearly half a century—the fact that these changes occur is significant. To the best of our ability, we must try to anticipate the changes and provide as much information on trends as is possible. Although we cannot foresee all that may happen, a real service will have been performed if young people are made aware of the dynamic character of the economy, and if they are prepared to expect changes and to adjust to them. This means maintaining the utmost flexibility by taking the broadest kind of training consistent with adequate preparation for a particular occupation.

The number of changes made by individual workers within the dynamic setting of growing population and labor force and shifting industries and occupations is great indeed. In a single year, a large number of people leave the labor force because of death, retirement, marriage, etc., while an even greater number, largely young people or married women, go to work. But this is only part of the story. The number of changes made by individual workers from job to job within an industry, from one industry to another, from State to State, or from one occupation to another are much more numerous than the movements into and out of the labor force in any given period. For example:

In a 27-month period during World War II, over 7 million civilian workers changed from one major occupational group to another.

In 1955, an average of 265,000 manufacturing workers quit their jobs each month.

Between April 1954 and April 1955, almost 2 million people in the labor force had moved from one State to another and more than 2 million other workers had moved from one county to another within a State. Taking into account the families of these workers, the number of people who move their place of residence is even greater. Thus, in April 1955, about 10.4 million people were living in a different county from the one in which they had been living in April 1954, and about 4.9 million of these people were living in a different State.

Only in recent years have we been able to measure the movements of individuals, and to appreciate the extent and significance of this type of economic change. These movements represent the adjustments people make to a changing environment. Without these adjustments the labor market could not function.

It is likely that most young people now in school will want to make similar changes in the course of their working life, either to improve their position, or because the change is forced upon them by loss of a job, poor health, or other causes. This suggests once more the importance of flexibility in preparing for an occupation.

To emphasize the changing character of occupational life, as well as to provide background for the reports on trends and outlook in each occupation, the growth and changing composition of population and the labor force, the major trends in industry, and their effect on broad occupational trends will be reviewed in the next few pages.

Population and Labor Force Trends

Population

A basic factor underlying the occupational outlook is the trend in population growth. Changes in the size and composition of the population influence the amount and types of goods which will be demanded at various times. These changes also have a direct bearing on the supply of labor—on the number and on the characteristics of the persons available for work.

Over the past century the population of our country has grown rapidly. This was particularly true in the decades prior to World War I, when the heavy influx of immigrants, the high birthrate, and the continuing reduction of the

death rate all combined to increase our population (chart 2).

Population growth has been closely associated with expanding economic opportunity. The rapidly growing domestic market for goods and services, combined with great gains in technology, provided the impetus for large-scale expansion of manufacturing, railroads, public utilities, construction, and other types of industry and business. Employment opportunities grew apace. Although there were, of course, great differences in the rate of expansion among different occupations, there were very few trades or professions which did not record a substantial gain in number from one decade to the next.

Up until the outbreak of World War II, the rate of population growth in contrast with the numerical increase was declining. Restrictions on immigration as well as the long-term decline in the birthrate tended to slow down the rate of population growth. During the depression years of the 1930's, there were sharp declines in the rates of marriages and births, reflecting the effect of unemployment and economic insecurity. As a result, the average annual rate of population increase dropped from 1.5 percent between 1920 and 1930 to only 0.7 percent in the following decade (chart 2).

CHART 2

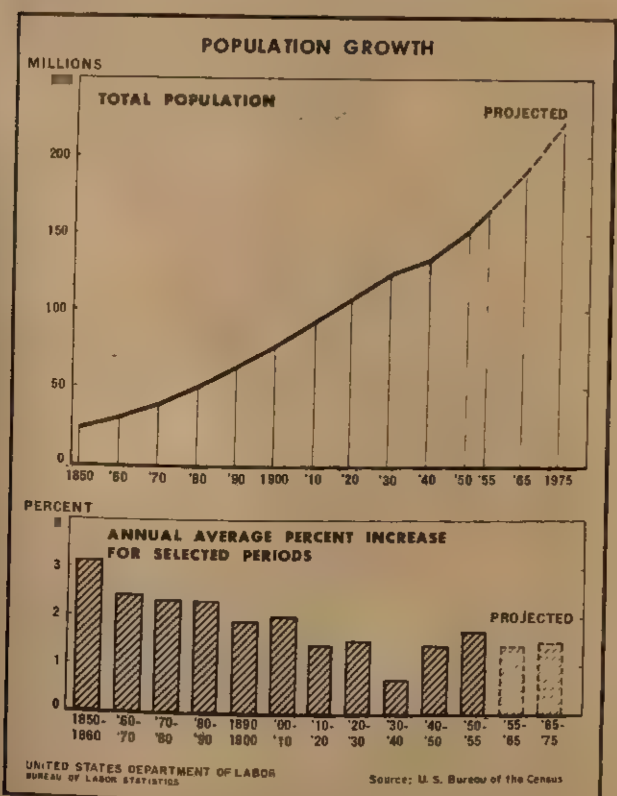
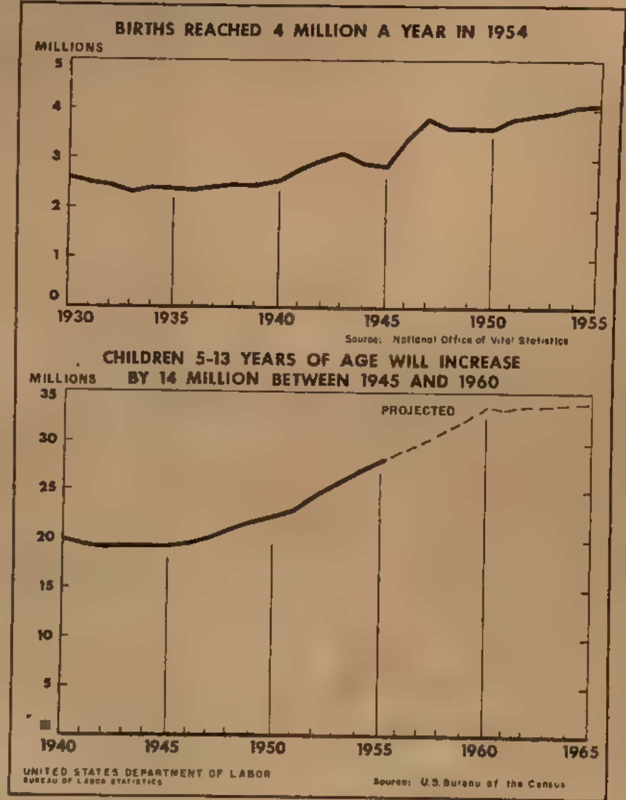


CHART 3



Record Number of Births

World War II marked the end of this downtrend in the rate of population growth. There was a sharp spurt in births during the early war years. After a brief slackening during 1944 and 1945 when millions of young men were overseas, marriages and births mounted to extremely high levels. The number of babies born in 1947 reached 3.8 million compared to a yearly average of 2.4 million during the period 1935 to 1939. The annual number of births remained high (3.6 million) between 1948 and 1950 and then started to climb again. By 1954 the number exceeded 4 million (chart 3).

As more and more babies born since 1940 reach school age, pressure on school facilities and teachers increases. The cumulative effect of the increasing number of births is dramatically shown by the sharp rise in the number of youngsters of elementary school age (chart 3). In 1955, there were 28 million children 5 to 13 years old compared with less than 19½ million 10 years earlier. By

1960, they will total about 33½ million—a rise of 14 million or almost 75 percent in a matter of 15 years. Since almost all youngsters in these ages attend school, enrollments in elementary schools will also show similar sharp increases (chart 3). High school enrollments, on the other hand, were still quite low in 1950. However, by 1955, the effect of increased births was beginning to appear in high school enrollments and the full impact will come in the early 1960's. After the peaks have been reached, both elementary and high school enrollments are likely to continue at very high levels. It is estimated that the number of pupils in secondary schools will increase from about 7½ million in 1955 to about 11½ million in 1965.

The large number of births in recent years has also been the major factor in increasing the rate of population growth. The average annual rate increased from 0.7 percent in the 1930's to 1.4 percent in the 1940's and will probably climb further to 1.6 percent in the 1950's.

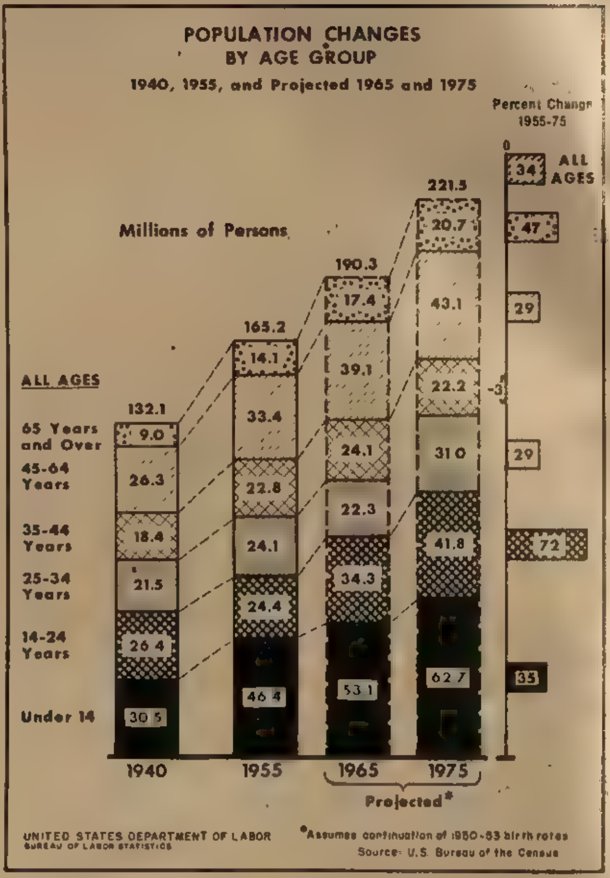
Many population specialists believe it is possible that the recent high birthrates will continue for a number of years. If the average birthrates for 1950–53 prevail through 1975, the total population will reach almost 180 million in 1960 and over 220 million in 1975. In terms of annual average percent increase, this would mean 1.5 percent for the period 1960 to 1975—as much as in the 1920–30 decade.

The continuing rapid growth of the population has very important implications for the occupational outlook. It means that in coming decades there will be many more people to be fed, clothed, housed, and provided with other consumer goods and services; it will call for expansion in production and employment in many industries.

Increase in the Aged Population

Another important population trend which is likely to continue for many years is the increase in the number of elderly persons (chart 4). The great advances in medicine and public health have enabled more people to live longer. In 1900, for example, only about 4 out of every 10 babies could expect to survive until age 65; at present, this proportion is about 7 out of 10. As a result, the number of persons 65 or over has been rising rapidly and their proportion of the total population has been increasing.

CHART 4



The number of persons 65 years or over tripled between 1900 and 1940—from 3 million to 9 million—while the total population increased by about 75 percent. By 1955, the number of elderly persons had increased to a little over 14 million. If recent trends continue these persons can be expected to number about 17½ million in 1965 and about 21 million in 1975—an increase of nearly 50 percent in the 20-year period, 1955–75.

As the number of older persons increases, we can expect increasing demands for medical services, for institutions to care for the aged, and for those types of goods and services which meet their needs. Problems of social security and old-age pensions will become more and more important. At the same time, we can expect increasing efforts to provide more adequate employment opportunities for the older worker. As technological advances result in shifts in the demand for workers, there will be increased need for guidance as to occupations which older persons might enter or for which they might train.

Rapid Growth Among 14- to 24-Year Olds

In the period 1955 to 1975, the population group 14 to 24 years old is expected to increase most dramatically. It is estimated that there will be a jump of 72 percent in the 14- to 24-year age group as against 35 percent for the youngest group and 47 percent for those 65 years of age and older. In 1955, there were slightly less than 24½ million 14- to 24-year-olds, 2 million fewer than in 1940 as a result of the low birthrates in the 1930's. In 1965, this group is expected to number more than 34 million, and in 1975, about 42 million.

In the coming two decades, the unusually rapid growth in the number of these young people will present unprecedented demands on our high school and college facilities. Their increased numbers will also provide heightened demand for housing and other commodities as they marry and have children. At the same time, they represent a source of increase in labor supply as they finish school and start their work careers.

The Labor Force

Although the growth of total population has a far-reaching effect upon the occupational outlook, we are more directly concerned with the "labor force," which includes not only employees who work for wages or salaries, but also farmers, self-employed businessmen, members of the Armed Forces, and those persons who are unemployed and looking for work. In 1955, the annual average number of persons in the labor force was nearly 69 million—about 58 percent of the population 14 years of age and over. Almost 21 million or 30 percent of the total labor force were women.

In the past, the rapid growth of the labor force largely paralleled the increase of population. The factors which influenced population growth also affected the rate of increase of the labor force. The work force nearly doubled during the 30-year period from 1890 to 1920 as large numbers of persons immigrated to this country and the high birthrates added large numbers of young workers to the labor force. However, with the slowing down in the rate of population growth there were corresponding declines in the rate of increase of the labor force. The annual average percent increase in the labor force went down from 2.4 percent for the period 1890–1900 to 1.6 percent for 1920–30. The further drop to 1.2 percent in the 1930's was due in part to the same economic forces which brought sharp declines in the marriage and birthrates—fewer youngsters, women, and older people were in the labor force than might have been the case if the depression had not curtailed job opportunities.

In the 1940's, with improving employment opportunities and wartime needs for additional workers, the downward trend was reversed. Between 1940 and 1945, the manpower needs of the Armed Forces and of industry brought into the labor force 8 million workers over and above the number expected on the basis of long-term trends. While most of these "extra" workers left the labor force shortly after the end of World War II, the annual average percent increase in the labor force over the whole decade (1940–50) rose to 1.4 percent. There has since been an acceleration in the long-term increase in labor force participation of adult women, partly as a result of work experience gained during the war by women who had not previously worked.

Population changes continue to play a decisive role in labor force growth in the present decade. Relatively small additions to the population of working age occurred in the first half of this decade, primarily because of the slump in marriages and births during the depressed thirties. As a result, the annual rate of increase of the labor force declined slightly to 1.3 percent, despite the economic expansion during the Korean period. Between 1955 and 1965, the labor force is expected to increase at about the same rate, rising from 69 million in 1955 to 79 million by 1965.

Trends in Labor Force Participation

Apart from overall population trends, there have been significant changes in the extent to which men and women of different ages have participated in the labor force. Almost all able-bodied adult men between the ages of 25 and 55 normally work or seek work. Over the years there has, however, been a steady increase in the proportion of adult women working outside the home, while the proportion of workers among youth and among older men has been declining. This is illustrated in chart 5 which shows the proportions of different age and sex groups of the population in the labor force in April 1920, 1950, and 1956.

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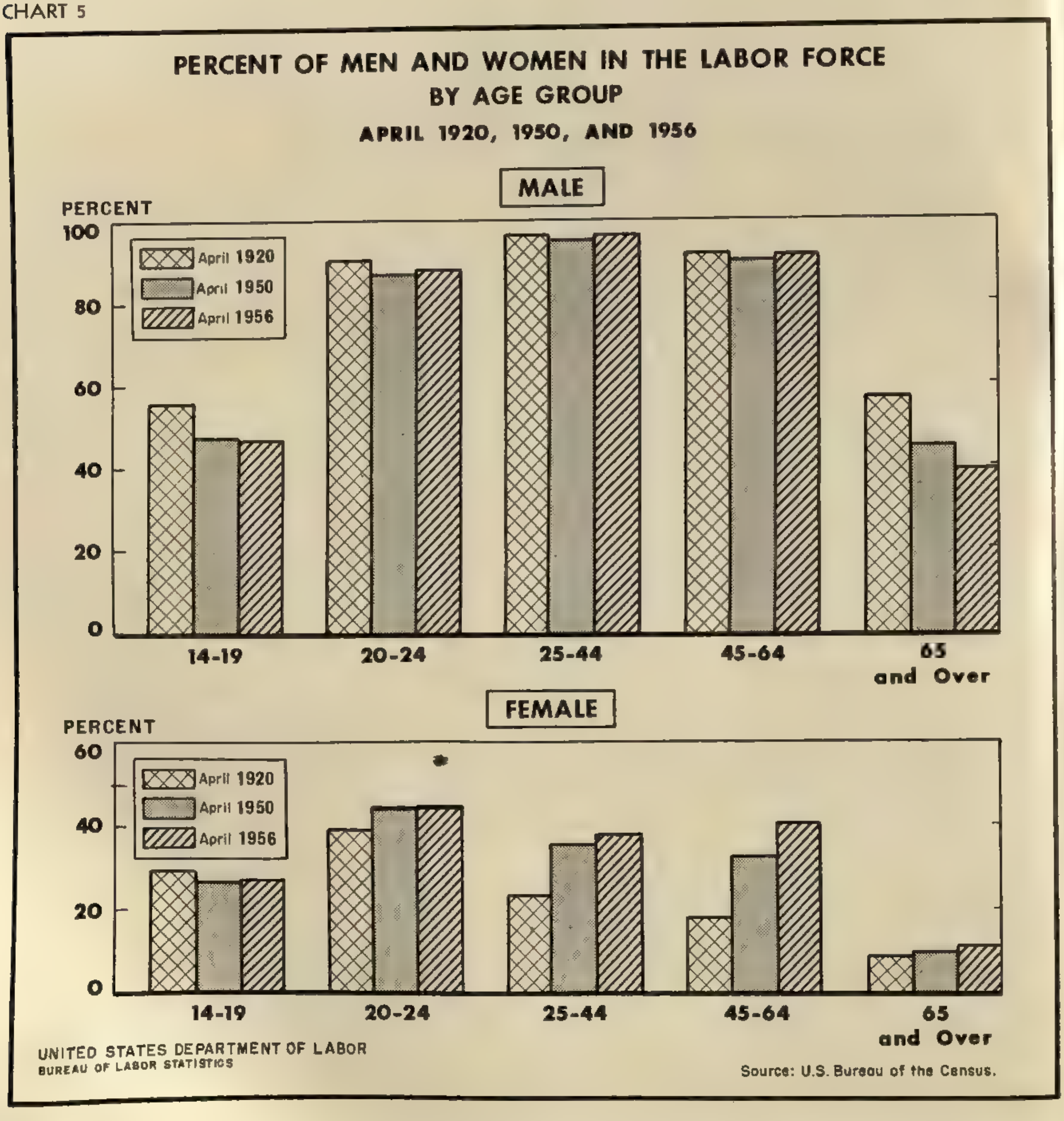
The movement of women into the labor force has resulted from a combination of factors. The shift of population to the cities and the increased importance of occupations such as clerical work, selling, and teaching, resulted in a great expansion of employment opportunities for women. At the same time, the introduction of labor-saving household devices made it possible for growing numbers of women to accept jobs outside the home. World War II accelerated this trend since many women who normally would not have worked took jobs and remained in the labor market.

The trend toward increasing participation in the labor force is particularly strong among women 35 to 64 years old. Also one can see in chart 5, a high proportion of women in their early twenties work—about 45 percent. Though many of these leave the labor force due to marriage and the necessity of caring for small chil-

CHART 5



dren, large numbers of them return as the children get older. In April 1956, 40 percent of women 45 to 64 years of age were employed or seeking employment.

In contrast to the trend for adult women workers, the proportion of youth in the labor force has been declining. There has been a steady lengthening in the period of schooling, partly because of compulsory school-attendance laws, but mainly because the skills needed by workers in our complex society have required a greater period of formal training. Also, veterans education provisions enabled many ex-servicemen to obtain higher education during the past decade. Though most of them are now out of school, the influx into the labor market of these trained veterans has further emphasized the importance of advanced education as a means of entry into the better paid occupational fields.

Although young people stay in school longer, the availability of job opportunities in recent years has caused many more students to take part-time jobs. Such part-time workers are counted in the statistics as "in the labor force." If they were excluded, the proportion of young people in the labor force would show an even greater decline.

Older men, particularly those 65 and over, are showing an increasing tendency to retire from the labor force at earlier ages. Improved public and private programs for old-age pensions and assistance have the effect of encouraging the earlier retirement of older workers. Furthermore, better economic conditions in the past 15 years have increased savings for retirement, despite the rising cost of living.

The coming of World War II caused a greater proportion of older persons to take jobs or postpone retirement. However, with a resumption of long-term influences and trends we find, for example, that the proportion of men 65 years of age and over in the labor force decreased from 45 percent in April 1950 to 40 percent in April 1956.

Despite this percentage decrease, the growth of the older population has been so substantial as to provide an increase in the absolute number of workers 65 and over in the labor force. The more than 55 percent increase in the population 65 years of age and over between 1940 and 1955 was accompanied by a 45-percent increase in the number of persons of this age in the labor force during this same period. Since the labor force of all ages only increased 23 percent between these same years, the older workers have thus assumed a more important role in our Nation's work force. They are presenting a growing challenge to industry and to personnel workers to find places for them in a complex industrial economy.

Movements Into and Out of the Labor Force

The labor force of the United States is not a static or rigidly limited group of people. On the contrary, it is a rapidly changing group. Many people have a great deal of freedom in their decisions to go to work or to quit work, and the size of the labor force is quite flexible in response to changing economic and social conditions and to the needs and desires of individuals.

Thus far we have discussed the labor force in terms of its size and composition at a particular time, or in terms of net changes from year to year. Estimates of this type do not reveal how many different persons actually enter or withdraw from the labor force each year. For example, since 1950, while the annual net increases in the size of the labor force have averaged close to one million, each year about 1¾ million young persons entered on a work career after leaving school and many married women returned to work as their children reached school age. At the same time, a substantial number of young women left the labor force because of marriage and the birth of children and many older workers withdrew from the labor force because of death or retirement.

In addition to these entries into or withdrawals from the labor force, there is a much larger volume of temporary shifting in and out, depending on the season and on changes in personal circumstances. During 1955, for example, an average of about 6 million persons moved into or out of the labor force from one month to the next.

Most of these shifts are temporary in character and are largely accounted for by the intermittent work activity of groups such as students and housewives. These temporary movements tend to follow a seasonal pattern. The beginning of summer vacations brings large numbers of young people into the labor force; in the fall, there are heavy withdrawals as students return to school. In farm areas, many people enter and leave the

labor force each year in response to the changing needs for labor in agriculture and related activities. In the city, the Christmas shopping season, with its expansion of employment in retail trade, brings many housewives and young people into the labor market for a few weeks in November and December. In addition, throughout the year, there is a considerable amount of temporary labor force entry and withdrawal arising from changes in local employment conditions and in the personal situation of individuals.

There are, therefore, many more persons in the population with some work experience than are likely to be in the labor force at any one time in the year. In 1955, for example, about 75½ million different persons worked during all or part of the year while the maximum number employed in any one month was 65½ million. Although many of the persons who worked only part of the year are not available for work through the entire year under normal conditions, they are important as a reserve group who may be attracted into full-time jobs during periods of national emergency, or when employment opportunities are particularly favorable.

Rising Educational Levels of the Labor Force

The labor force has not only been growing rapidly in size but its quality has been improving in terms of basic educational preparation. Nowadays more young people are going to school for longer periods than formerly. For example, at the time of the 1950 Census nearly half of the persons 25 to 34 years of age had completed high school while less than a fifth of the persons 55 years of age and over had this much schooling. Furthermore, in comparison with the older group almost twice as large a proportion of the younger group had completed 4 years of college. In 1955, the number of college degrees granted amounted to 13.6 percent of the population 22 years of age as compared with only 1.8 percent in 1900. The number of high school graduates equaled 62.0 percent of the population 18 years of age in 1955, almost 10 times greater than the comparable 6.3 percent in 1900.

Many factors have contributed to this rising educational level. Most States have raised the minimum age at which children may legally leave school. They have established laws which prohibit the employment of youngsters under a minimum age and which limit the kinds of work young people may perform.

Moreover, greater concentration of population in cities and metropolitan areas has made schools more accessible to a much larger number of people. Improved economic conditions have also enabled more students to remain in school longer than was previously possible.

Another factor is the increasing number and complexity of skills demanded in modern industry. To meet these needs, employers have raised educational qualifications for many jobs, especially the more desirable ones. These higher standards must be met not only by job applicants but also by job holders seeking promotions.

Regional Differences

National trends in population and labor force may not, of course, be indicative of changes in a particular region or locality. In a Nation as large and diversified as the United States, there are bound to be geographic variations in the rates of population and labor force growth; in part, these variations reflect regional differences in birthrates and death rates.

A more important factor, however, has been the magnitude and pattern of migration between States in response to economic opportunity. For example, in the early 1950's about 5 million persons moved from one State to another each year. Allowing for the fact that some of these interstate movers return to the States where they previously lived, the numbers involved indicate the magnitude of the recent geographic movement of population.

The most rapid population growth between 1940 and 1955 occurred on the Pacific Coast and in adjacent Mountain States, primarily because of a very heavy net in-migration. The population in the West increased by two-thirds between 1940 and 1955, while the national population increased only by one-fourth.

In contrast, most of the Southern region (excluding the South Atlantic States) lagged behind

the national rate of population increase. In fact, a few of the southern States showed net losses in population. Here, too, migration was the dominant factor. On the basis of birthrates, the South would have had the fastest growing population. However, this growth was largely offset by migration of southerners to other areas. Consequently, the population of the South increased by only one-fifth from 1940 to 1955.

The population of the North Central region during this period also increased by about one-fifth. This change resulted from a rise of about 25 percent in the Great Lakes States, and an increase of only 10 percent in the Great Plains States. Although the natural rates of population growth were about equal in these two geographic divisions, the Great Lakes States gained migrants while the Great Plains States lost them.

In the Northeastern region, both the New England and Middle Atlantic States had similar patterns of population growth. With very little change as a result of migration and with the lowest natural rate of increase in the country, this region had only a 16-percent population rise.

In the main, the recent shifts of population have continued the long-run trends in population movement in the United States. During World War II, however, these movements were greatly accelerated, as workers and their families poured into the coastal shipbuilding and aircraft centers and into the war production areas of Michigan, Ohio, and other industrial States. Most of the migrants stayed on after the war ended. In fact, the flow of population into many of these areas has continued at a high rate in the postwar period.

Closely related to the geographic patterns in population growth are the regional variations in labor force growth. Between 1940 and 1955, the civilian labor force of the Nation as a whole increased by 18 percent. In the West, the civilian work force grew by 55 percent, reflecting mainly the large influx of migrants. On the other hand, in the South, where considerable net-outmigration occurred, the labor force increased by only 10 percent. There was a 13-percent increase in the Northeastern region and a 20-percent increase in the North Central region.

These data indicate that a significant proportion of young people growing up and going to school in a given area move to other areas some time after they reach working age. In helping young people make vocational plans, it is necessary to be aware of occupational trends throughout the Nation as well as in their own localities.

Industrial and Occupational Trends

Recent Employment Trends

Young people in high schools and colleges today have lived most of their lives through 15 years in which employment opportunities have generally been good. Things have not always been this way, and a brief review of recent economic history will help young people to gain proper perspective.

Trends in employment are shown in chart 6, which extends from 1929 through the depression of the thirties, World War II, and the postwar period. In the top line is seen the gradual growth of the labor force and rapid increase during the war as students, women, and older workers responded to the manpower needs of the Armed Forces and civilian industry.

The 1930's

The severe drop in employment in nonfarm industries that marked the onset of the depression—from 37 million in 1929 to a little less than 29 million in 1933—is also shown. As a result of the drop in employment and the growth of the labor force, the number of unemployed increased from about 1½ million in 1929 to nearly 13 million in 1933.

Those in school today do not remember the depression years; their attitudes are influenced more by the conditions of relative prosperity since 1940. Yet the thinking of their parents, of their teachers, of the employers for whom they may work, of the unions they may join, and of the leaders in

public life, is still strongly affected by the experiences of the thirties. It will help in understanding much of the information on occupations contained in the Handbook if one has a realization of the difficulties of those years.

Among the general effects of the depression decade upon occupations and employment were these:

1. Young people particularly found it difficult to get jobs. The rate of unemployment was high among them, despite the fact that many continued in school and were not classified as unemployed. Older workers also found it difficult to get jobs.

2. Employers, faced with many job applicants and the necessity to save money by having only the most efficient workers, raised their hiring standards. The best trained or experienced workers got the jobs. This hastened a long-term trend toward a preference for applicants with more education.

3. People got jobs where they could, and so there was a great deal of occupational shifting down the scale of skills. Many a professionally trained and experienced worker took a clerical, sales, or semiskilled job. Many a craftsman worked in semiskilled or laborer jobs. Their skills grew rusty from disuse.

4. To preserve the employment security of their members, and to prevent poorly trained people from entering their fields, some unions and professional societies took action to tighten up entrance requirements. Often this went hand in hand with the improvement of training. In the professional fields, particularly, such action represented the continuation of a long-term trend toward raising the standards of education and training.

5. Earnings, of course, dropped in nearly every field of work.

6. In an effort to spread the available work among as many people as possible, the workweek was shortened in many industries.

A slow recovery began in 1936, temporarily set back by a recession toward the end of 1937. By 1939, the year the war began in Europe, nonfarm employment had increased by 7½ million from the low in 1933, but was still a million below its average in 1929. However, unemployment had been reduced by only 3⅓ million from the peak of nearly 13 million, since the labor force had continued to grow.

Changes During and Since World War II

The recovery was accelerated by the expanded production for World War II. In a 5-year period, 20 million additional people were taken into military service and war-supporting industry. Nonfarm employment rose rapidly from 36 million in 1939 to 45 million in 1944. The Armed Forces, which had averaged about 300,000 throughout the decade of the thirties, added 11 million more men and women within 4 years. As a result, the number of unemployed dropped from 9½ million in 1939 to about two-thirds of a million in 1944—most of these being workers temporarily between jobs—and millions of additional people entered the labor force.

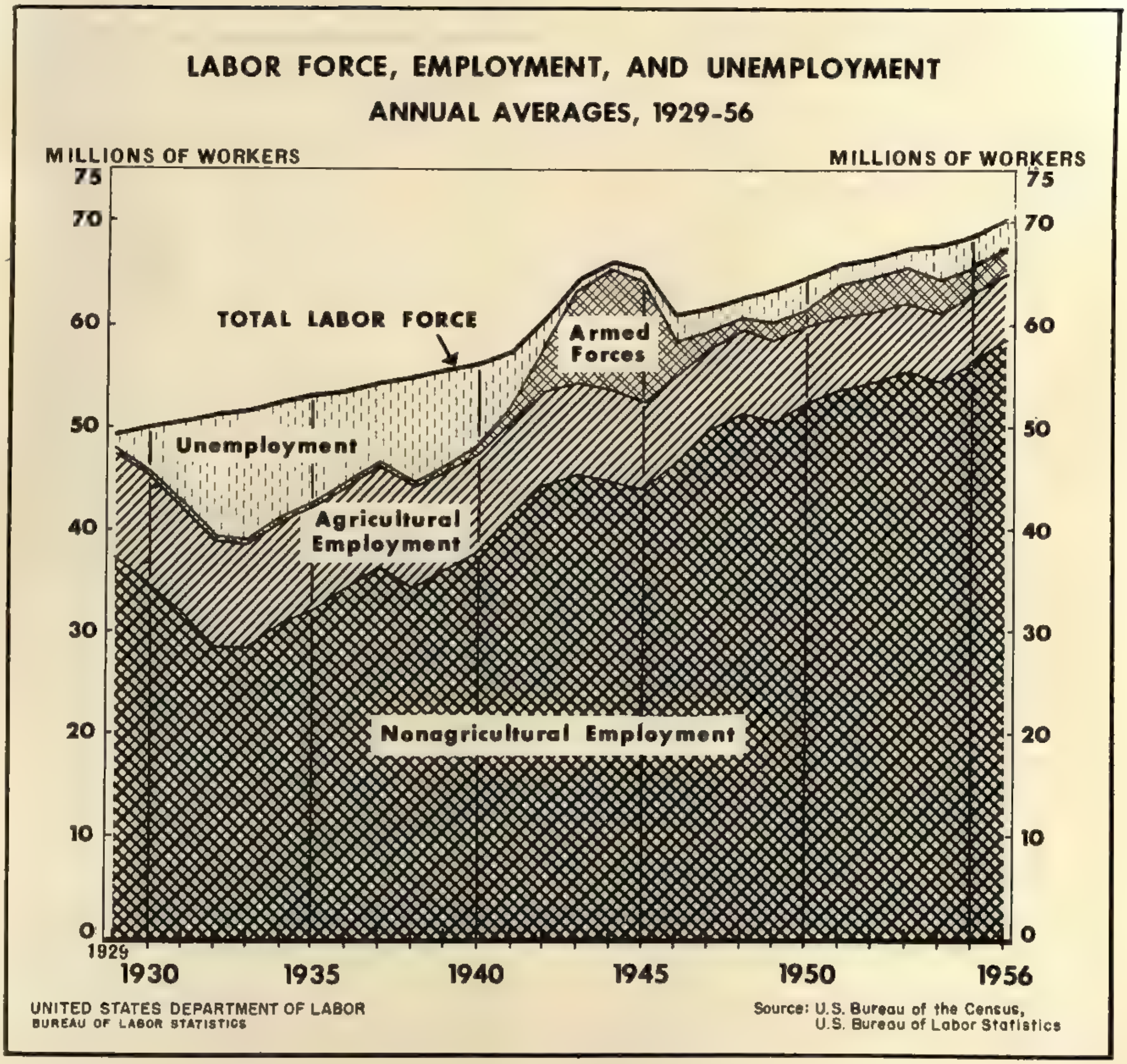
Hiring standards which had been stiffened during the depression were relaxed. Skilled jobs which had required a long period of training were broken down so that the work could be done by a number of quickly trained workers, often under the supervision of a skilled worker. Young people found it easy to get jobs. Older workers postponed their retirement because their skills were needed in industry and they could earn good pay. Women whose children could do without their care came into the labor market.

The period since the war has been one of generally good business conditions and high employment levels interrupted by only two temporary recessions—in 1949 and 1954.

Immediately after the war, workers who were no longer needed for munitions production were hired by other industries. A heavy demand for the products that had not been available during the war, such as new houses, automobiles, and washing machines, stimulated industry to invest over $20 billion a year in plants and equipment, and to hire more and more workers. At the end of 1948, with the Armed Forces reduced from over 11 million to less than 2 million, nearly 60 million people were employed, only 2 million unemployed.

By 1949, some of the backlog of consumer demand had been worked through. Employment decreased by about 700,000. Since the total labor

CHART 6



force was rising because of population growth, the number of unemployed persons increased to an average of 3.4 million in 1949—the highest for any year since 1941.

A new upturn in business activity and employment began in early 1950, however. Gains were accelerated in the middle of the year, owing to the outbreak of hostilities in Korea and plans for expanded defense production. Employment continued to increase and unemployment to decrease until the latter part of 1953. At the close of the Korean conflict, as business activity fell off from these record levels, average employment dropped by 1 million between 1953 and 1954. Unemployment doubled in this period averaging 3.2 million for 1954.

In 1955, the economy recovered rapidly from the 1954 downturn. A substantial job expansion

took place in the latter half of the year and in 1956, when average employment reached 65 million and unemployment was down to 2½ million.

Thus, in the 11 postwar years, the economy advanced rapidly and the number of jobs rose to new highs. In the two economic setbacks we did have, employment dropped by only a million or less, in contrast to the 9 million drop in the 1930's.

Industrial Trends

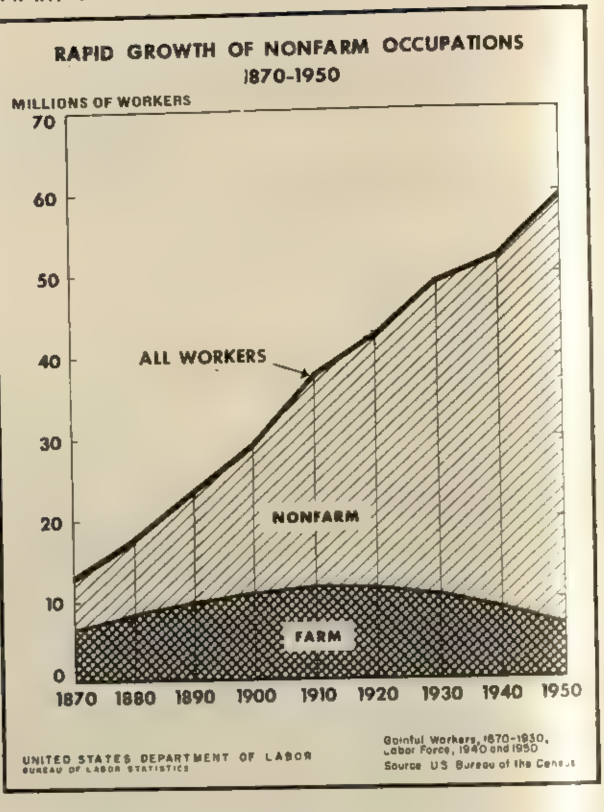
The growth of the Nation's work force in recent years has been accompanied by marked changes in the industrial distribution of employment. Many powerful forces have contributed to these changes. In the past three decades our country has experienced periods of depression and prosperity and war and peace. Technological developments have been revolutionary. Products and industries which were once of outstanding importance are now in decline, and other products and industries have moved into leading positions. For example, the television, aircraft, and atomic energy industries, to mention only a few, now play a part in our economy which it would have been impossible to foresee only a few years ago. It is thus of obvious importance to persons planning careers to be aware of the trends in various industries, as well as of the substantial past and anticipated growth of the labor force as a whole.

Shift From Farm to Nonfarm Employment

One of the most impressive long-term trends in our national economy is the increasing predominance of nonagricultural as compared with agricultural employment. In 1870, more than half the people who worked for a living were employed in agriculture. The United States was mainly a country of farmers; its ways of living and habits of thinking were influenced by this fact. Indeed, today, in any group of students in a city school, there will very likely be some whose grandparents or parents lived and worked on farms.

The significant change that occurred since 1870—the rapid growth of industry, commerce, and other nonfarming employment—is shown in chart 7. The number of nonfarm workers grew from 6 million in 1870 to 52 million in 1950, while

CHART 7



the number of farmers and farm workers increased from about 7 million in 1870 to a peak of 11½ million around 1910, and since then actually declined to about 7 million in 1950, the same level as 1870. Farm employment continued to decrease between 1950 and 1955—although the decline appears to be slowing down.

On any farm today, one can see some of the reasons why this happened. The farmer has machinery which makes it possible for him to cultivate many more acres than could the farmer years ago. With tractor and trucks both on the farm and in the city, much less feed is needed for horses and mules. Millions of acres that once grew feed for work stock are now devoted to food crops or to feed for cattle, hogs, and poultry. Moreover, farmers get more production out of their farms as a result of improved scientific methods, including the use of more fertilizer, better seed, and improved breeds of livestock. By 1950, the average farmer produced nearly twice as much as did the average farmer just before World War I.

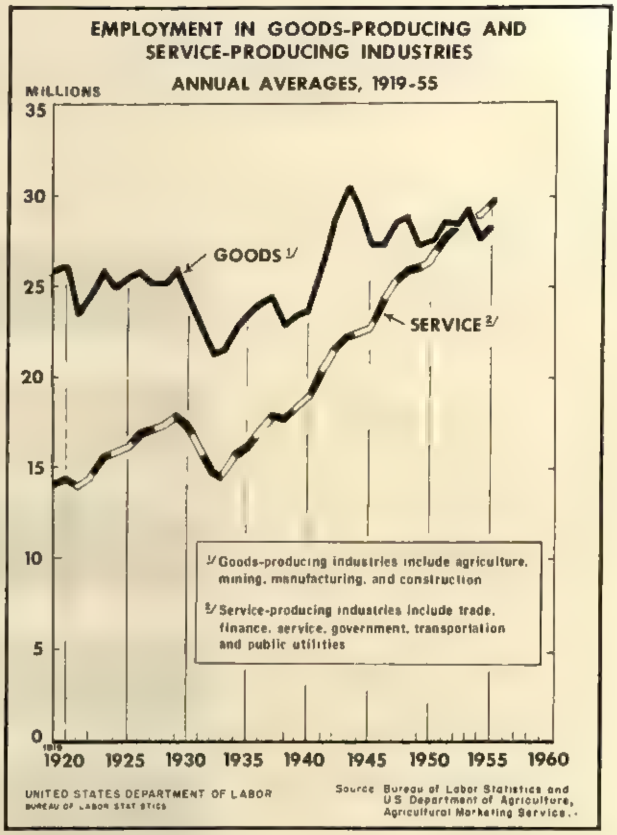
With these improvements in farming and with improvements in storage and transportation of food—canning, refrigeration, freezing and warehousing, for example—the American farmer is able to provide food and other farm products for more and more people. This makes it possible for some of the young people who grow up on farms to take advantage of opportunities in industry.

Shift From Manufacturing to Service Industries

Mainly because of the decline in the number of people engaged in farming, employment in the goods-producing sectors has not increased as much as employment in the service-producing sectors of the American economy. In this comparison, the goods-producing segment of the economy includes all wage and salary employees in the extractive industries (coal, oil, gas, lead, zinc, etc.), construction (the building of homes, highways, factories, and offices), manufacturing industries (steel, clothing, machinery, autos, chemicals, etc.), and all persons working in agriculture (feed, food, and fibers). These industries turn out all of the goods we produce. The service-producing segment here includes all wage and salary workers in activities which involve buying, selling, financing, transporting, communicating, servicing, teaching, etc.

Chart 8 illustrates the growing importance of the service industries. In 1919, annual average employment was 14 million in the service industries and 26 million in the goods industries. By 1955, there were nearly 30 million persons employed in the service sector, 2 million more than the 28 million employed in the goods sector.

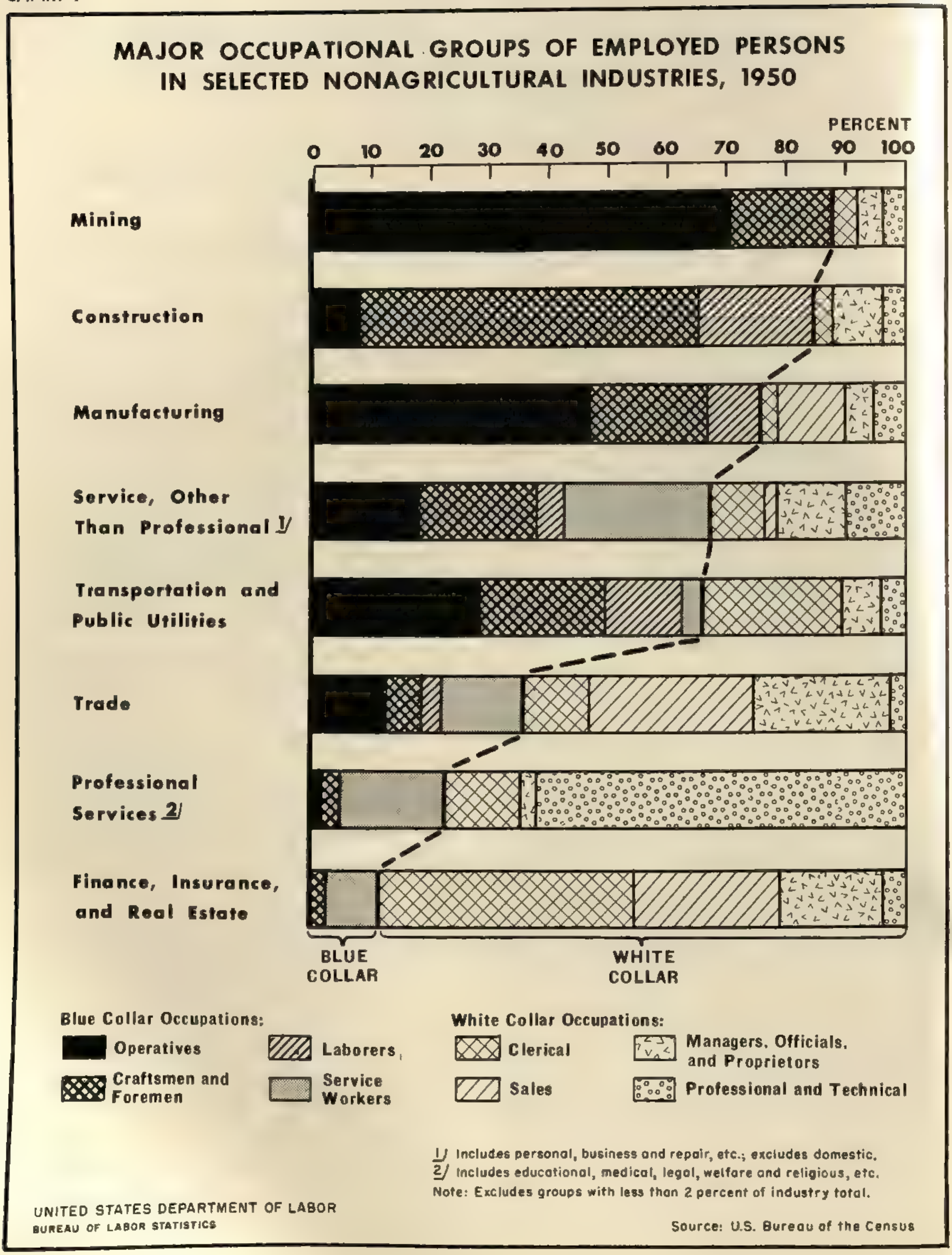
CHART 8



The fact the more workers are now engaged in the production of services than of goods is an important milestone in the evolution of the standard of living in the United States. In the first 50 years of the 20th century, the gross national product per capita (adjusted for price change) has doubled. This has been achieved with a labor force which, as a percentage of the population, has remained practically unchanged between 1900 and 1950 and with a labor force working far fewer hours now than at the turn of the century. At the same time, young people have been afforded more time for education, older people more time for retirement, and the population as a whole more time for recreation and leisure. This tremendous gain in output (much of which is reflected in our standard of living) has been attained mostly through major advances in technology which have been particularly dramatic in agriculture and manufacturing. These advances have made possible the enormous increase in the production of goods with comparatively modest employment increases and the employment of significantly increasing numbers of workers in the service industries.

While employment in the nonfarm sector has about doubled in the past four decades, its industrial composition during this period of rapid growth has remained fairly stable. In most years, manufacturing has accounted for about one-third of all nonfarm workers and trade for about one-fifth. The relative importance of employment in finance has also shown little change. There have been decreases in the proportions of workers engaged in mining and transportation and increases in the proportions working in government and

CHART 9


MAJOR OCCUPATIONAL GROUPS OF EMPLOYED PERSONS
IN SELECTED NONAGRICULTURAL INDUSTRIES, 1950
PERCENT
0
10
20
30
40
50
60
70
80
90
100
Mining
Construction
Manufacturing
Service, Other Than Professional 1/
Transportation and Public Utilities
Trade
Professional Services 2/
Finance, Insurance, and Real Estate
BLUE COLLAR
WHITE COLLAR
Blue Collar Occupations:
Operatives
Craftsmen and Foremen
Laborers
Service Workers
White Collar Occupations:
Clerical
Sales
Managers, Officials, and Proprietors
Professional and Technical
1/ Includes personal, business and repair, etc.; excludes domestic.
2/ Includes educational, medical, legal, welfare and religious, etc.
Note: Excludes groups with less than 2 percent of industry total.
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS
Source: U.S. Bureau of the Census

service industries. The proportion of construction workers has fluctuated from year to year depending on business conditions.

Goods-Producing Industries

Manufacturing. Manufacturing industries employ the largest number of people and offer jobs to many different kinds of workers: the unskilled laborer, the machinist, the engineer, the stenographer, the production manager, and—more than any other type of worker—the operative, or semiskilled worker (chart 9). Nearly half of all employees of manufacturing industries in 1950 were operatives.

The number of jobs in manufacturing rises sharply when general business conditions are good and falls more than in most other industries during depressions. Manufacturing employment fell from about 10½ million in 1929 to 6¾ million in 1932, but recovered gradually to 10 million by 1939. This was followed by a very sharp increase to 17⅓ million by the peak war year of 1943. Manufacturing employment accounted for as much as 41 percent of all nonfarm jobs during World War II and as little as 29 percent in 1932. Aside from these abnormal periods, however, manufacturing has usually accounted for about 1 out of every 3 nonfarm jobs.

Although manufacturing employment in 1955 was still somewhat below the wartime peak, it appears that underlying its fluctuations there has been a slowly rising trend since World War II. Industrial production has expanded greatly in these years, but this has been achieved with a relatively small increase in employment because of the tremendous rise in output per man-hour. The likelihood is that this situation will persist during the next few decades—that there will be a moderate continued growth in manufacturing employment but even greater gains in production, made possible by further technological advances and a consequent rise in productivity. However, as in the past, there will be varying trends in employment and productivity in different manufacturing industries.

There has been a major employment shift in manufacturing from nondurables (food, tobacco, textiles, etc.) to the durable-goods industries (automobiles, machinery, etc.). Employment in the hard-goods industries more than doubled between 1939 and 1955, whereas employment in the soft goods industries rose by only 30 percent. In 1939, about 55 percent of all manufacturing employees were in nondurable goods industries; by 1955, only 42 percent were in these industries—7 million as compared to 9½ million in durables.

Increased productivity also made possible the employment of proportionately fewer factory workers in the production of such necessities as food and clothing. Thus, textiles, apparel, and food in the nondurable goods group employed less than 1 out of every 4 factory workers in 1955 as against 1 out of 3 in 1939. In the textile industry, which in 1939 was numerically the most important employer in manufacturing, employment declined in absolute numbers as well as relative to all manufacturing employment. Among the nondurable goods industries only chemicals—which is closely related to durable-goods production—grew as fast as the average for all durable-goods industries.

Most of the employment increase in the hard-goods industries was concentrated in machinery, electrical machinery, and transportation equipment (mainly motor vehicles and aircraft). These industries employed more than 1 out of every 4 factory workers in 1955 as compared with 1 out of 6 in 1939.

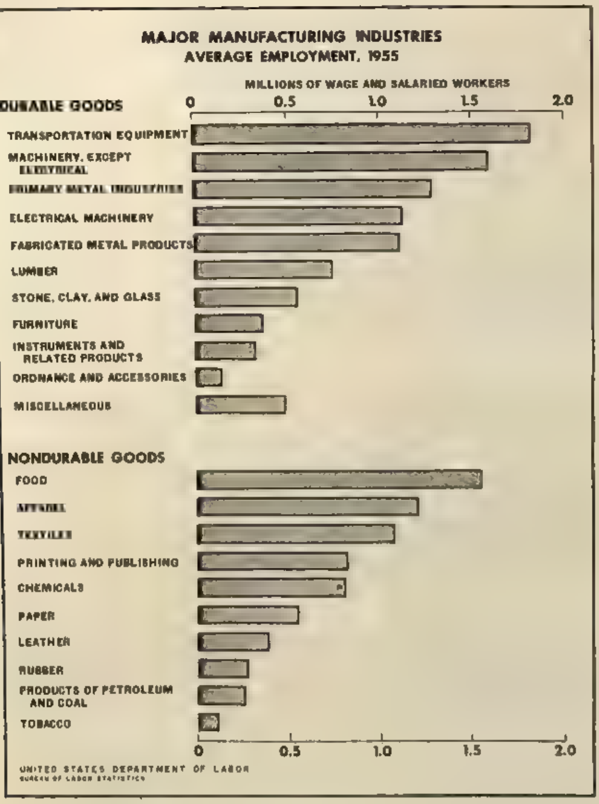
The major manufacturing industries and their relative importance as a source of employment are shown in chart 10.

Mining. This industry division is the only major one showing a decrease in employment since 1919 (chart 11). While nonfarm employment increased almost 85 percent since 1919, employment in mining declined by one-third. This decline, persistent over the past 35 years, reduced mining employment as a proportion of nonagricultural employment from a little over 4 percent to 1.5 percent.

The overall decrease in mining employment masked a series of divergent trends in employment among the individual mining industries. Between 1939 and 1955, employment declined 62 percent in anthracite mining, 44 percent in bituminous coal mining and 2 percent in metal mining. Over the same period, there were increases of 65 percent in petroleum and natural gas production and 41 percent in nonmetallic mining and quarrying.

Construction. When general business conditions are good people buy new homes and industry in-

CHART 10



vests in new plants; in bad times, families and business firms put off spending that can be postponed. For this reason, employment in the construction industry has fluctuated greatly over the years. It dropped by almost 50 percent between 1929 and 1933, expanded sharply in the early years of World War II as defense plants and army camps were built, then dropped because of wartime shortages of materials and labor. After the war, employment in this industry showed a relatively steady growth until 1951 and then remained high at 2.6 million between 1951 and 1954. In 1955, it reached 2.8 million, at which time there were about 2¾ times as many construction employees as in 1919.

Agriculture. Farming is still one of the largest fields of employment although it has declined for several decades (chart 7). There are sharp seasonal fluctuations in the number of farm workers. The number of persons whose major activity is farm work varies from 5 million in the winter to about 8 million during the summer and early fall when large numbers of additional family members and hired help work on the farms. Many of those who work during the peak season are students and housewives during the rest of the year.

Service-Producing Industries

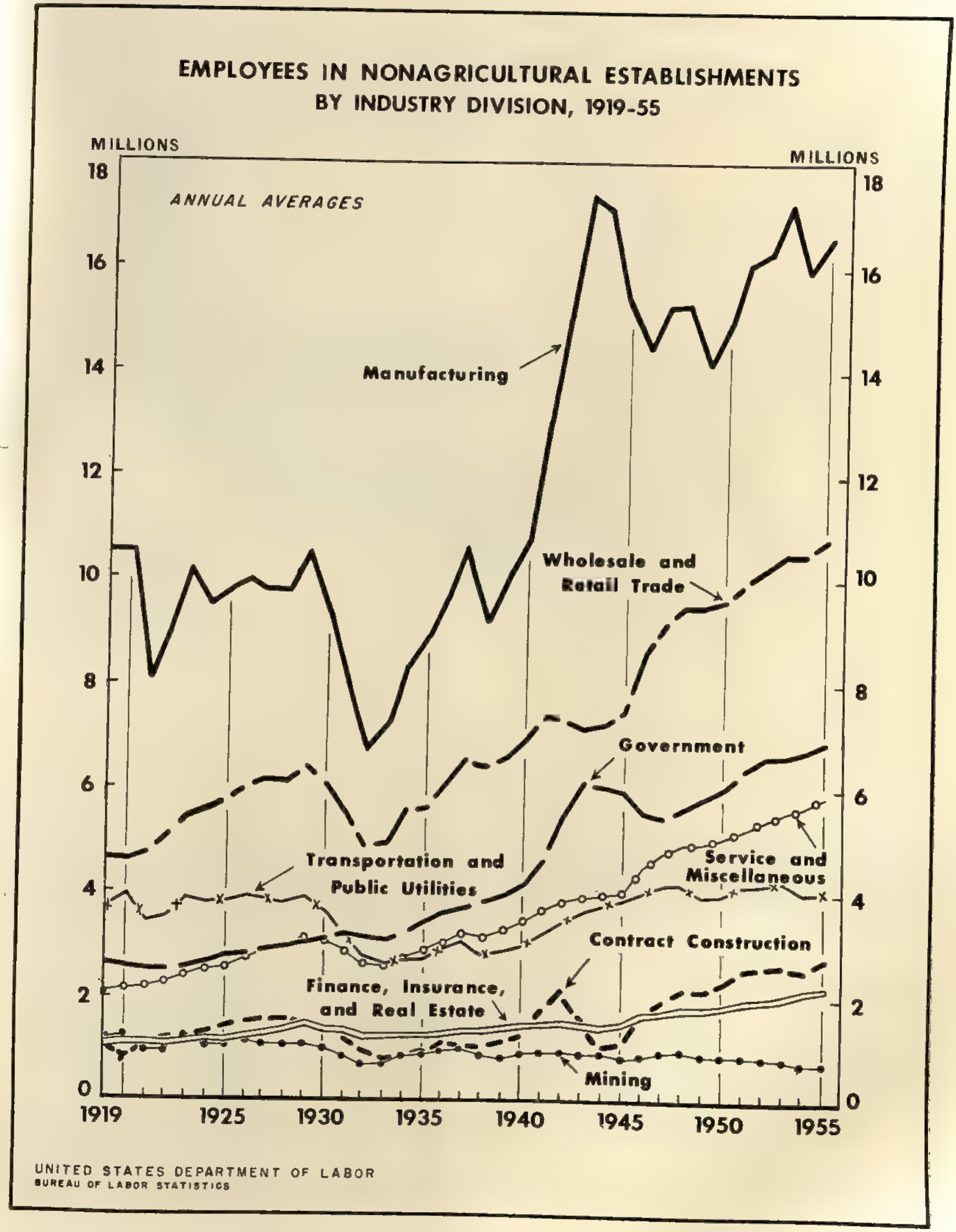
Trade. The number of employees in retail and wholesale trade is exceeded only by the number in manufacturing. In 1955, employment averaged 10.8 million. In addition, there were about 2½ million proprietors. Salesmen and saleswomen constitute the largest groups of employees in trade, but there are also large numbers of clerical workers, truck drivers, delivery men, and building service workers, such as elevator operators and porters (chart 9).

Employment in trade more than doubled between 1919 and 1955. Though employment in trade fell sharply at the beginning of the depression, it recovered quickly. By 1939, it was actually above where it was in 1929. The number of employees in trade decreased slightly during the war but has since increased sharply.

Service. Service industries in 1955 employed almost 6 million people in such diverse fields as automobile and other repair shops, laundries, cleaning and dyeing establishments, hotels, barber shops, theaters, motion-picture production, advertising, and many other categories not commonly thought of as in the service field. Between 1919 and 1955, employment in these industries almost tripled—the greatest percentage increase of any industry group in this period. Though the long-term upward trend was interrupted for a time during the depression, service industries had more employees in 1939 than in 1929. Service employment growth slowed down again during the war. However, it has climbed strongly and steadily since then.

Government. Government employment—local, State, and Federal—was 6.9 million in 1955. More than two-thirds of the workers were in local and State governments, employed in such occupations as teacher, nurse, engineer, typist, and policeman. In shipyards, arsenals, and printing plants, the Federal Government employs many workers in industrial occupations. Although people often think of the clerical worker as the typical government worker, only a fifth of government workers were in this category in 1955. One of the largest Federal occupations is that of mail carrier.

CHART 11


EMPLOYEES IN NONAGRICULTURAL ESTABLISHMENTS
BY INDUSTRY DIVISION, 1919-55
MILLIONS
MILLIONS
ANNUAL AVERAGES
18
16
14
12
10
8
6
4
2
0
Manufacturing
Wholesale and Retail Trade
Government
Transportation and Public Utilities
Service and Miscellaneous
Contract Construction
Finance, Insurance, and Real Estate
Mining
1919
1925
1930
1935
1940
1945
1950
1955
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Government employment, following the pattern of service industries, was 2½ times greater in 1955 than in 1919. It dropped back only slightly from 1931 to 1933, increased during the balance of the depression, and rose very sharply during the war. Following a decline immediately after World War II, it has increased every year since 1947, mainly in State and local governments. Much of the rise in government employment is accounted for by the government's providing increased services through the schools, public health and sanitation, welfare work, and similar fields. A larger defense establishment, services to veterans, and a growing amount of research has increased the number of Government employees.

In addition to the civilians employed by the Federal Government, there were 3 million men in the armed services in 1955. The Armed Forces use men and women in hundreds of different occupations, such as machinist, airplane mechanic, and electrician, and give courses of training in these and many other fields.

Finance, Insurance, and Real Estate. The most common occupations in this field are clerical. There are also a large number of sales personnel. A high proportion—nearly half—of the persons employed in this industry are women. A great number of these have clerical jobs in insurance companies and banks. Many of the men are employed as insurance and real estate agents.

Employment in this industry more than doubled from 1919 to 1955. This long-term upward trend was interrupted twice—once by the depression and once by World War II. From 1945 to 1955, employment in finance increased by more than half with greater activity in building and real estate, increasing purchases of insurance and stocks and bonds, and expanded use of banking facilities.

Transportation, Communications, and Public Utilities. In the transportation, communication, and public utility industries, major sources of employment are the railroads, trucking companies, bus and transit lines, telephone and electric power companies, and the merchant marine. Airlines and radio and television broadcasting are smaller fields, but seem to be of considerable interest to young people. The whole group of industries employed 4 million workers in 1955, of whom two-thirds were in transportation. Many different occupations are included, such as locomotive engineer, truck driver, telephone operator, musician, engineer, seaman, ticket agent, and Pullman porter. The great majority of the workers are men. Most of the women employed in these industries are clerical workers.

Employment in these industries was nearly 4 million during most of the 1920's—was about a million less during the depression years—and has since remained in the vicinity of 4 million. In fact, there is practically no difference between the employment figures of 1920 and 1955. Since total nonagricultural employment increased considerably during this period, the proportion employed in transportation, communication, and public utilities declined by nearly one half.

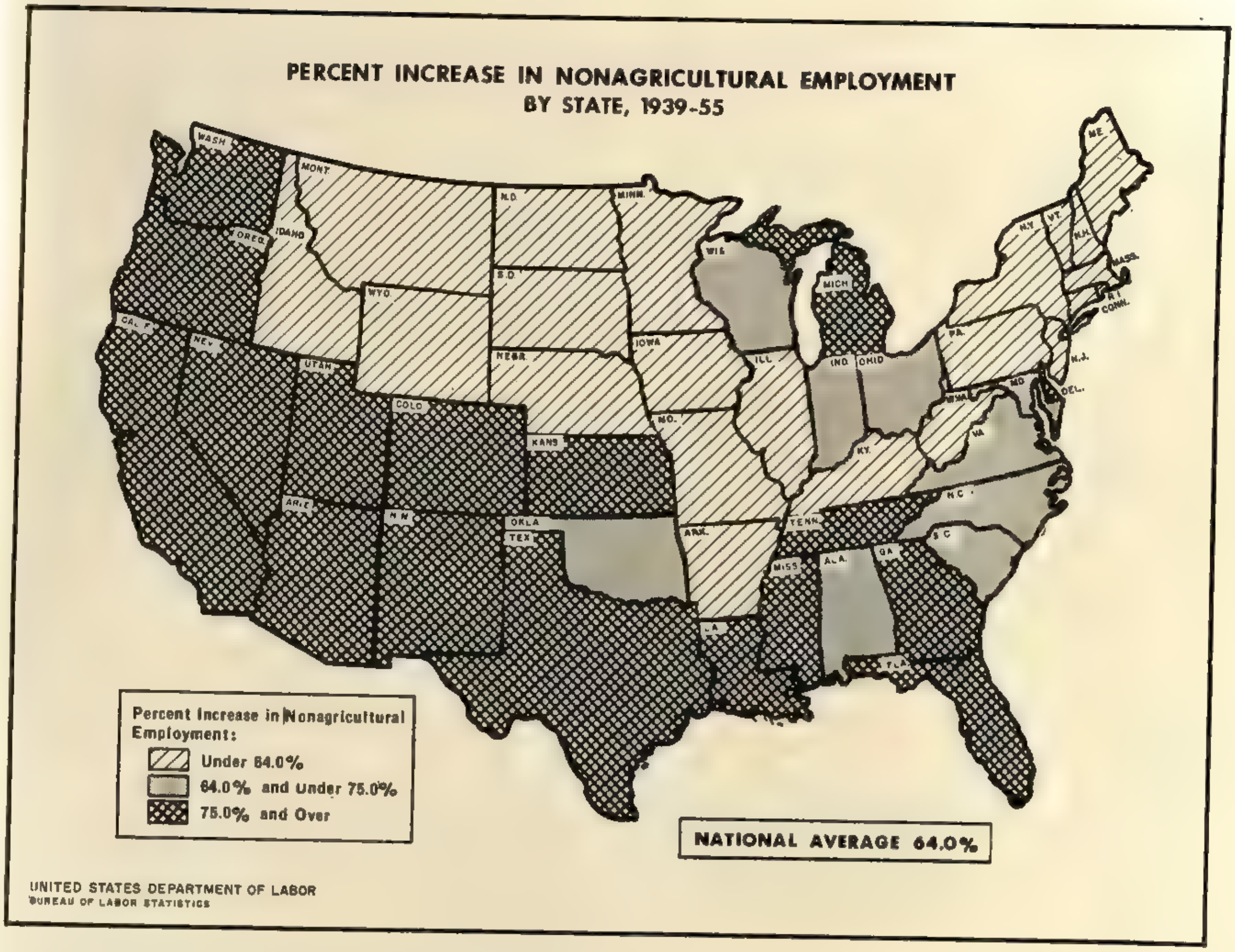
While employment in this division has remained fairly constant, there have been very large increases in freight carried, telephones in use, and output of electricity as a result of greater productivity. There have also been shifts in the importance of the different industries within the group. Thus, employment on interstate railroads, still the biggest component of the transportation field, fell almost 25 percent from 1947 to 1955; employment in buslines and local railways dropped 35 percent. The increases, as expected, came in the newer modes of transportation—almost 40 percent each in trucking and warehousing and in air transportation.

Geographic Changes in Industry

Nonagricultural employment in the United States rose from 30 million in 1939 to 50 million in 1955—a rise of about 65 percent compared with a rise of 25 percent in the population. Employment in each of the States also increased during this period but there was a very great variation among them in rate of growth. The States in the West, Southwest, Gulf, and South Atlantic regions led the Nation in the rate of growth (chart 12). Many of these States experienced huge expansions in the number of nonagricultural jobs. California and Texas together, more than doubled their employment—from 2.9 million in 1939 to 6.3 million in 1955.

The New England and Middle Atlantic regions showed the lowest rates of increase from 1939 to 1955. States in these regions experienced employment gains substantially below the national average, except Connecticut where the employ-

CHART 12



ment rise almost equalled the national rate. Connecticut expanded its employment considerably in the fields of finance and insurance, trade, and service, and maintained its concentration of metalworking. Five of the six States with the smallest increases are in the New England region.

The interior regions—the East North Central (Great Lakes States) and the West North Central (Great Plains States)—made employment gains at approximately the national average rate. In these two regions, the States which exceeded the national average included Kansas with major new production capacity for aircraft manufacturing and such States as Ohio, Indiana, and Michigan, with metalworking facilities.

One of the most interesting and significant developments during this period has been the passing of the Middle Atlantic region (New York, New Jersey, and Pennsylvania) from its long time preeminence. In 1939, this region accounted for the largest portion of employment in each of the eight major industry divisions. By 1955, however, the region had already lost its leadership in three of the divisions (mining, construction, and manufacturing) and had almost lost the lead in trade. The growing importance of petroleum and gas put the West South Central States (Arkansas, Louisiana, Oklahoma, and Texas) ahead in the field of mining. The East North Central region had taken over the lead in construction and manufacturing and had nearly as much employment in trade as the Middle Atlantic States.

The Great Lakes States were, in 1955, less than 1 percentage point behind the Middle Atlantic region in the proportion of nonagricultural jobs, and may soon take the lead. The major factor in this development seems to be the shift in manufacturing jobs. During the war, the Great Lakes States overtook the Middle Atlantic in percentage

of all manufacturing jobs. This lead has been extended since then. In 1955, the Great Lakes States had 29 percent of all manufacturing jobs compared to 25 percent for the Middle Atlantic States.

Geographical shifts in nonagricultural employment can be explained in large part by different rates of industry growth, particularly in manufacturing. Sharp gains in manufacturing in the West and South since 1939—especially in California and Texas—were the main cause of the increased proportion of nonagricultural employment in these areas. The emergence of the Great Lakes States as the country's leading manufacturing area was the major cause for this region being the only one outside of the South and West to maintain its share of the Nation's nonagricultural workers.

The construction industry, where employment had decreased very sharply during the depression, showed the greatest relative employment increase, about twice the percentage for manufacturing. Construction accounted for a larger share of nonagricultural workers in 1955 than in 1939 in 45 of the 48 States. The greatest percentage increases in construction were in the Pacific, Mountain, and Great Lakes States. In 1939, California had only half as many employees in this industry as did New York, but in 1955, California outranked New York in construction employment.

Although employment in mining declined between 1939 and 1955 for the Nation as a whole, there were large increases in the petroleum-and gas-producing areas of Louisiana, Oklahoma, and Texas. These were not large enough to offset very sharp drops in important coal-mining States, such as Pennsylvania, Kentucky, Alabama, and West Virginia, and in metal-mining States, such as Nevada.

The greatest gains in trade, service, finance, and government were consistently in the South and West, and accounted for much of the increased proportion of nonagricultural jobs in these areas. Florida's great popularity as a resort center, the expansion of trade around large military bases in many of the southern and western States, and the emergence of Dallas and Los Angeles as major style centers, illustrate some of the factors which generated the employment in trade in these regions. In finance, insurance, and real estate, Houston, Los Angeles, and San Francisco were among the cities showing the largest increases. Employment in the service industries had the sharpest gains throughout most of the South and West, particularly in Texas, and all of the Mountain and Pacific States. Government employment almost doubled in the South Atlantic, West South Central, and Mountain States and increased nearly 2½ times in the Pacific States.

Between 1939 and 1955, transportation (including communication and public utilities) showed the smallest employment increase of any major industry, except mining. In fact, in 44 of 48 States the proportion of the nonagricultural workers in transportation declined. Even in most of the South and West, where transportation had greater employment increments than elsewhere, it grew more slowly than other industries.

Despite these significant shifts in the location of industry—generally to the South and West—it is important to note that the basic geographic structure of American industry is still very much like it was some 15 years ago. The concentration of industry and commerce, job opportunities, manpower requirements, and labor supply remains to a significant extent in the regions and States where it had been more than a decade ago.

The geographical distribution of manufacturing employment provides an illustration of this point. As already indicated, the geographical differentials in rates of growth of manufacturing have been significant. Manufacturing jobs in California increased almost 185 percent between 1939 and 1955, in contrast to only a 20-percent rise in Massachusetts. Nevertheless, 1 out of every 3 factory jobs in the Nation is still found in the 9 States comprising the New England and Middle Atlantic regions. Despite some very important geographic shifts, the first 15 States in size of manufacturing employment in 1939 were exactly the same 15 States in 1955.

In other industries, similar concentrations remain. The geographic area comprising the New England, Middle Atlantic, Great Lakes, and Great Plains States still employs about 6 out of 10 of the Nation's workers in trade, finance, service, and transportation, and over half of those in construction and government. Only in the case of mining does the combined South and West lead—with 7 out of 10 workers.

Occupational Trends

The occupational picture in chart 13 shows the broad areas of work in which people are engaged. It can be seen that more workers are employed in the semiskilled group, including occupations such as factory machine operators and truckdrivers, than in any other major occupation group. Clerical workers make up the second largest group, and the skilled craftsmen and foremen group is the third largest. The clerical and service groups are the only major groups which employ more women than men.

The white-collar group of occupations, including the administrative, professional and semiprofessional, clerical, and sales workers groups, accounted for about 39 percent of the workers employed in the Nation in July 1956. Among the white-collar occupation groups, the clerical group is the largest employment field for women and the administrative field provides the largest number of jobs for men.

The principal occupations within each major group shown in chart 14 will be covered in later sections of this Handbook, together with the trends in the major groups. This section will summarize data on long-term trends in the distribution of workers among the various socioeconomic occupational groups.

During the 40-year period from 1910 to 1950, broadly significant changes were taking place in the occupational composition of the labor force (chart 14). One of the most notable changes was the sharp decline in the proportion of farm workers. Farm owners and tenants decreased from 16.5 percent of the work force in 1910 to 7.3 per-

CHART 13

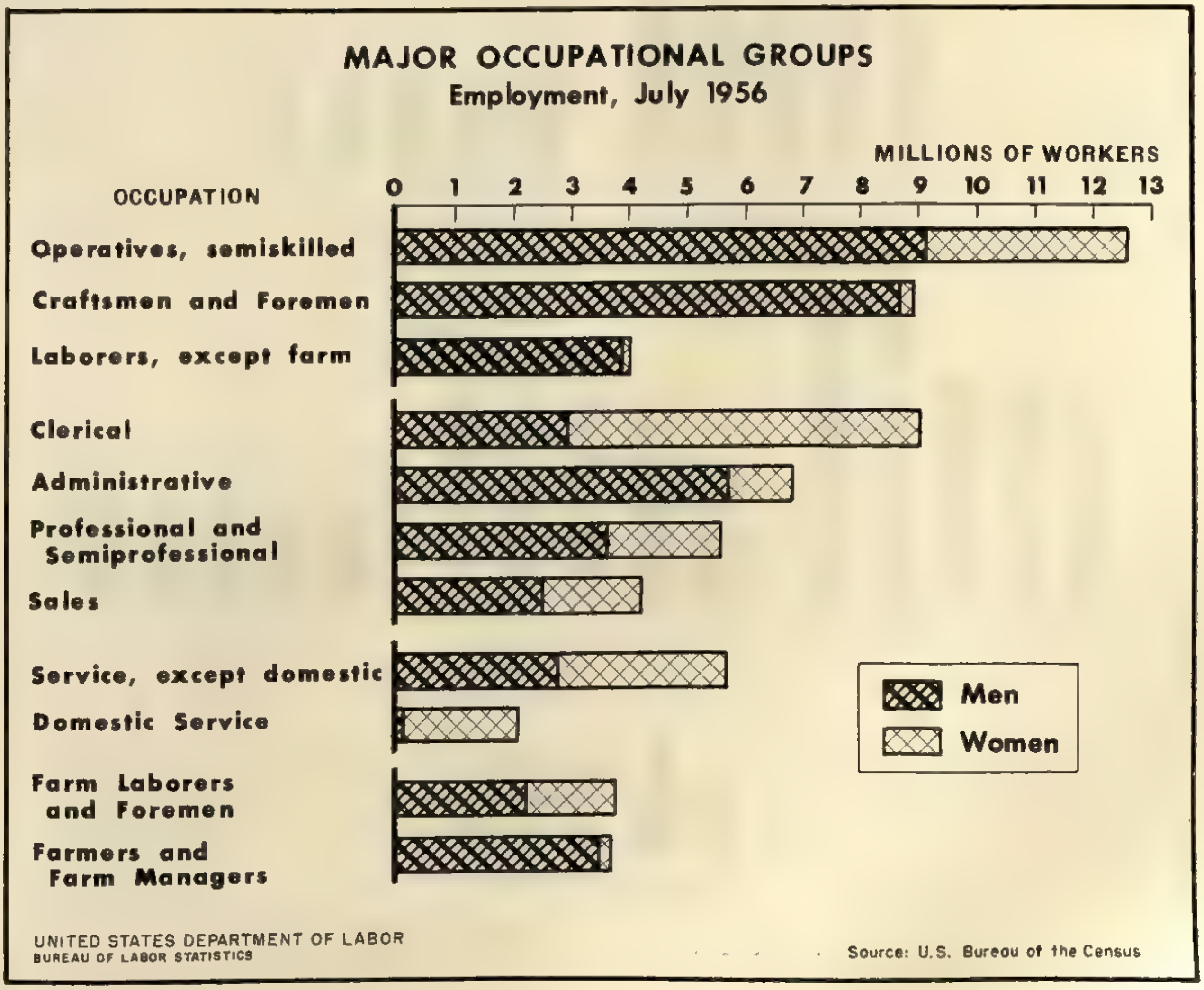
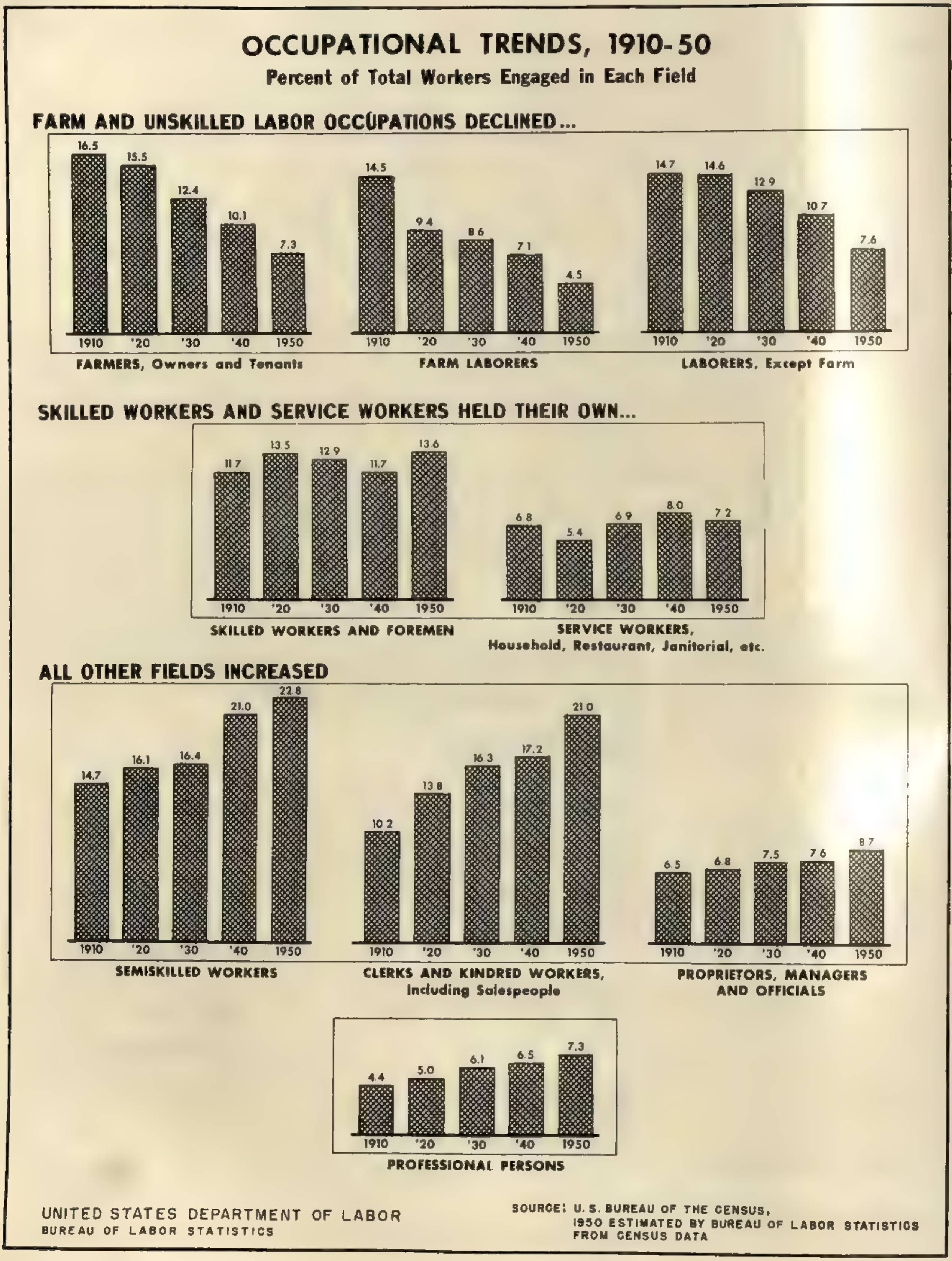


CHART 14


OCCUPATIONAL TRENDS, 1910-50
Percent of Total Workers Engaged in Each Field
FARM AND UNSKILLED LABOR OCCUPATIONS DECLINED...
16.5 15.5 12.4 10.1 7.3
1910 '20 '30 '40 1950
FARMERS, Owners and Tenants
14.5 9.4 8.6 7.1 4.5
1910 '20 '30 '40 1950
FARM LABORERS
14.7 14.6 12.9 10.7 7.6
1910 '20 '30 '40 1950
LABORERS, Except Farm
SKILLED WORKERS AND SERVICE WORKERS HELD THEIR OWN...
11.7 13.5 12.9 11.7 13.6
1910 '20 '30 '40 1950
SKILLED WORKERS AND FOREMEN
6.8 5.4 6.9 8.0 7.2
1910 '20 '30 '40 1950
SERVICE WORKERS,
Household, Restaurant, Janitorial, etc.
ALL OTHER FIELDS INCREASED
14.7 16.1 16.4 21.0 22.8
1910 '20 '30 '40 1950
SEMISKILLED WORKERS
10.2 13.8 16.3 17.2 21.0
1910 '20 '30 '40 1950
CLERKS AND KINDRED WORKERS,
Including Salespeople
6.5 6.8 7.5 7.6 8.7
1910 '20 '30 '40 1950
PROPRIETORS, MANAGERS
AND OFFICIALS
4.4 5.0 6.1 6.5 7.3
1910 '20 '30 '40 1950
PROFESSIONAL PERSONS
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS
SOURCE: U. S. BUREAU OF THE CENSUS,
1950 ESTIMATED BY BUREAU OF LABOR STATISTICS
FROM CENSUS DATA

cent in 1950. The proportion of farm laborers decreased even more, from 14.5 percent in 1910 to 4.5 percent in 1950. These declines stemmed from the technological revolution in farming which made possible a steady increase in output of farm products with a declining number of farm workers. Nonfarm laborers were the only other group which declined over the entire 40-year period—from 14.7 percent of the work force in 1910 to 7.6 percent in 1950. Increasing mechanization in many nonagricultural industries was undoubtedly the chief factor underlying this decline. Along with future technological progress, we may expect a continuing downward trend in the proportions of farm workers and nonfarm laborers.

The proportion of skilled workers decreased from 13.5 percent in 1920 to 11.7 percent in 1940, but then rose in 1950 to 13.6 percent—about the same as the previous high in 1920. The growth in the proportion of skilled workers between 1940 and 1950 was caused primarily by increases in three groups of skilled occupations: skilled construction trades, mechanics and repairmen, and foremen.

Recent technological advances, popularly known as automation, are expected to require additional numbers of skilled workers for the design, production, installation, and maintenance of new automatic machinery. Additional skilled mechanics and repairmen will also undoubtedly be needed to repair the growing amount of complex mechanical equipment, such as automobiles, television, and household appliances, being used by American consumers.

Under the classification systems used in chart 14, the service workers group includes only such occupations as household workers, restaurant cooks and waiters, and janitors. This group grew in proportion from 6.8 percent of total workers in 1910 to 8.0 percent in 1940 but decreased in relative importance by 1950 to 7.2 percent. The decline in this socioeconomic group between 1940 and 1950 was caused by the decline in numbers of private household workers. Assuming that the country continues to have full or nearly full employment, it appears likely that the proportion of household workers will continue to decline. Workers in household jobs can move more easily to other fields of work in periods of full employment. On the other hand, employment in restaurants and some other service occupations will probably rise.

All the other occupational fields shown in chart 14 have gained steadily in relative importance since 1910. Semiskilled workers increased from 14.7 percent of total workers in 1910 to 22.8 percent in 1950. This rise was effected partly by the trend toward increasing mechanization in many manufacturing industries and partly by the rapid growth of the service industries, which employ large numbers of workers in this group. The introduction of automation may tend, in coming decades, to reduce slowly the proportion of workers in semiskilled occupations in the manufacturing industries. However, the number of semiskilled workers in the expanding service industries is expected to continue to grow.

Clerical and kindred workers, including salespeople, are the group which grew most rapidly between 1910 and 1950—from 10.2 to 21 percent of all workers. In the future, the introduction of automatic office machines may tend to reduce the number of routine clerical jobs in industries such as insurance, which employ many clerical workers. However, changes are expected to be slow and moderate, and in the clerical and sales group as a whole, offsetting growth is expected.

Professional persons as a group increased between 1910 and 1950 from 4.4 percent to 7.3 percent of all workers. Over the 40-year period, this group grew in relative importance more than any other group except the clerical and sales occupations. Future technological progress will undoubtedly tend to create increased demand for engineers and other technical workers. Our increasing population—and especially the growing numbers of old and young people—is creating and will continue to create a growing need for doctors and other health service personnel, and for teachers. Industry is using more and more accountants and other professionally trained persons in administrative positions. Growing numbers of people trained in the social sciences and human relations will also be needed. Thus, the relative importance of the professional group may be expected to continue to increase.

Earnings From Work

The purpose of this chapter is to throw some light on the complicated subject of wages, salaries, and other forms of labor income in the United States. It is partly designed to suggest the range of earnings that young people entering the labor market can expect to receive in the immediate future. It is calculated also to point to certain long-run trends in earnings that may have a bearing on job decisions.

Earnings and Occupational Choice

In the process of occupational choice, a crucial consideration clearly relates to the earnings or income that a job affords. In addition to money income, however, there are other factors that need to be taken into account in evaluating alternative types of employment. Jobs within the range of an individual's abilities, interests, and training will frequently differ in a host of characteristics. Some yield more of what economists call "psychic income" than others. In some fashion, a balance must often be struck between money and psychic income in making job choices.

The term psychic income may not be familiar, but the concept is important and can be readily illustrated. For example, an individual may place a comparatively high value on leisure; partly for this reason, he may decide on a college teaching career, although other jobs within his field of choice may offer greater money income. Another individual may choose a routine job in the air-conditioned comfort of a modern office rather than a manual job offering higher earnings. The desire to be one's own boss or to work at one's own pace undoubtedly explains many of the small enterprises that exist precariously in our towns and cities; the proprietors, in many instances, could make higher incomes if they were willing to become the employees of others.

In substance, jobs may differ with respect to such factors as the physical conditions under which they are performed, the extent and type of supervision required, the opportunity afforded for initiative and individual recognition, the public esteem in which they are held, the personal associations they foster, and the amount of leisure they provide. Where choice between two or more jobs is possible, these "noneconomic" factors should be carefully considered. A job is more than a means to a living; it helps materially to shape an individual's pattern of life.

It is appropriate, however, that prospective money earnings should be given great weight in occupational choice. The income that a job yields will largely determine the level of well-being that an individual and his family can enjoy. It is plainly important that levels of living be sufficiently high to sustain health and efficiency and to provide for the education and training of children. Beyond this, there are many satisfactions, both material and cultural, that require income for their realization.

Wage Rates, Earnings, and Supplementary Benefits

Earnings arise out of the production of goods (clothing, radios) or services (haircuts, legal advice). They are payments to individuals for physical or mental effort directed toward the satisfaction of human wants. They measure, at least in a rough way, the contributions that individuals make to production. It follows generally that earnings, on the average, will tend to be high when output (in the sense of production per man) is high.

Rates of Pay. The productive services (work) that individuals perform carry prices. These prices are expressed in various ways, but they can all be reduced to payments for a unit of time or a unit of output. For example, a machinist in a metalworking plant in Chicago may be paid $2.35 an hour. An experienced accounting clerk in a Chicago office may be paid a salary of $85 a week. These are examples of *time rates* of wages or salaries. Time rates for manual workers are typically set by the hour; for office, supervisory, and professional workers by the week, month, or year.

The other basic type of rate is expressed in terms of a unit of output. For instance, a worker may receive 5 cents per piece for machining a small metal part. An employee of an automobile

service station may be paid 85 cents for washing a car. A television or furniture salesman may be paid a commission (perhaps 5 percent) based on the value of the goods he sells. These are all forms of *incentive rates*. Earnings, in these cases, depend directly on output. It is useful for many purposes to compute an "earned rate"—that is, a rate related to time—for workers paid on an incentive basis. The earned rate is obtained by dividing earnings (excluding premium pay, if any) by hours worked during a pay period. Thus, if our service station employee washed 55 cars at 85 cents per car during a 40-hour period, thereby earning $46.75, his earned rate per hour would be $1.17 ($46.75 divided by 40).

Aside from the question of the duration of employment, the wage rate is the most important element in earnings. A young person considering an occupational choice will want first to find out as definitely as possible what the basic rate of pay is. No particular difficulties are presented in the case of time rates. For jobs paid by the piece, it will be necessary to determine as closely as possible the expected "earned rate" for the occupation in the firm. This information will generally be furnished by a prospective employer. Time-rated occupations in particular may carry an entrance rate, with progression to the full job rate depending on length of service, performance on the job, or both. Piece or other types of incentive rates may be combined with some sort of minimum earnings guaranty.

Wage Rates and Earnings. The earnings that a given wage or salary rate will yield depend largely on the amount of employment that can be obtained at the rate. A comparatively high rate per hour or per week does not necessarily mean correspondingly high earnings over a year. The relatively high hourly or daily rates for manual work found in some types of employment, such as building construction or longshoring, are due in part to the fact that annual earnings are pulled down by part-time work. Some industries, such as clothing manufacturing, offer much more employment at some periods of the year than at others. The earnings of independent professional workers, such as doctors, dentists, and lawyers, whose fees are essentially piece rates, clearly are affected by the volume of work they secure. The wide range of earnings among lawyers, for example, reflects not only differences in rates (fees) but perhaps more importantly differences in quantity of work (number and type of cases).

In evaluating the earnings potential of different jobs, therefore, great attention should be paid to stability of employment. Some people temperamentally prefer a high rate of pay with intermittent employment, but the choice should be deliberate. On the whole, office, administrative, and professional employees tend to have greater job security than employees paid on an hourly basis. They are, by and large, more difficult to replace, and the need for their services is not so closely geared to changes in the outputs of the firms for which they work. However, the job security of many hourly rated workers is also quite high, especially in establishments and industries in which production schedules are reasonably steady. The seniority provisions of union agreements, which govern the order in which employees are laid off if staff reduction becomes necessary, provide a measure of security to those workers with some years of service with a firm.

It is difficult to look very far ahead. In some situations, however, it is almost essential to think in terms of lifetime earnings. The working life of a professional athlete, for example, is comparatively short. An occupational decision might involve a choice between professional baseball, with the chance, but not the certainty, of high earnings for a few years, and a career in electrical engineering, with reasonable assurance of steady earnings over the long pull. Another example is the choice for a young lawyer between salaried employment with a government agency and independent practice with a chance at the glittering prizes that accrue to a few at the top of the legal profession. An instance on another level is the choice between an occupation which offers a comparatively high wage rate but requires more than average physical stamina, and a physically less exacting job with a lower wage rate. Over a lifetime, earnings may well be greater in the second occupation.

Earnings and the Job Ladder. Consideration of occupational earnings prospects over the span of a working life obviously involves consideration of the prospects for advancement from lower to higher paying jobs. Almost any job can lead to another; the absolutely dead-end job is a rarity. Even the most routine work, if done well, can provide the way to a more responsible and better pay-

ing job. There may be an opportunity for on-the-job training for a more responsible position, or the employee may have to exercise sufficient initiative to secure additional formal training, often of a specialized character, at local educational institutions.

Some entrance positions obviously offer better prospects than others for salary progression or job advancement, or both. The young college instructor, if he is reasonably competent, can look forward to attaining full professorial rank; his inclinations may lead him into a deanship or some other academic administrative post. In public school teaching, there is typically a steady progression from entrance salary to the top of the salary range, and again there are opportunities for administrative positions within the school system. In general, professional occupations over most of an individual's working life tend to offer higher remuneration with advancing age, experience, and attainment.

The high school or college graduate entering upon a business career has many possible avenues open to him in production, marketing, finance, and other aspects of business organization. In many large business firms, promotion tends to be from within, and opportunities will exist for alert young people to move up the job ladder. In many types of service establishments, which tend to be small, the acquisition of experience may provide the basis for the opening of an independent business. One of the limiting factors here is the need for some capital from savings or a loan. But many a service station, garage, television repair shop, or small hotel has been opened by individuals who began as employees in these types of enterprises. As suggested earlier, the psychic income derived by many people from business proprietorship must often compensate for money earnings that are lower than the same individuals could command as employees.

The fact must be emphasized, of course, that millions of individuals will remain within their initial general white-collar or manual job category throughout their working lives. Young people who enter coal mining will tend to remain miners; business-machine operators will tend to remain in this general field; most factory operatives will tend to form a permanent attachment to some particular type of work. In these cases, only limited increases in earnings from job shifts can be anticipated; higher earnings and living standards will result primarily from the general rise in productivity in the economic system.

Premium Pay and Supplementary Benefits. The discussion thus far has dealt with earnings as a function of the basic wage or salary rate and the amount of employment available at that rate. Under certain conditions, premium payments may result in direct additions to money income. The payment of a premium for work beyond the daily or weekly standard of hours is now widely embodied in legislation, collective bargaining agreements, and employer practice. A special premium for work on late shifts is frequently paid. There are other types of premiums, but those for overtime and late-shift work are the most common.

In addition to money earnings, most jobs typically yield a variety of benefits that represent sources of leisure and security for employees and items of expenditures for employers. There is no uniformity in these benefits from industry to industry or even, very often, among firms in the same industry. For this reason, attention should be given to supplementary benefits in appraising job opportunities in different companies or industries. One important type of benefit involves payment for time not worked, the most important items relating to provisions for paid vacations, paid holidays, and paid sick leave. Such benefits used to apply largely to white-collar and professional employees. In recent years, they have been widely extended to manual workers.

Another important group of benefits includes pension plans and health and insurance plans financed wholly or in part by employers. The growth of such plans during the past decade has been remarkable. Private pension plans are designed to supplement the retirement benefits to which most workers are entitled under the Federal Old-Age and Survivors and Disability Insurance system. Health and insurance plans are frequently comprehensive in scope, including life, accidental death and dismemberment, and sickness insurance, hospitalization, surgical, and medical care benefits. These benefit plans, if carefully drawn and administered, contribute substantially to the income security of employees, and should be taken into account in weighing alternative job opportunities. A new type of plan—supplementary unemployment benefits—has recently appeared in the automobile, steel, and some other industries, and is designed to increase employee

protection against loss of income through layoff; workers laid off are paid extra weekly amounts by their employers in addition to the unemployment compensation benefits they receive from the State.

The Dimensions of Income From Work

In 1955, as table 1 shows, the national income of the United States reached the staggering total of 324 billion dollars. Of this amount, 223 billion, or 69 percent of the total, represented wages, salaries, and other labor compensation. Actually, income from work was greater than these figures indicate. A portion of the 39 billion dollars representing the income of unincorporated enterprises—including farm, independent professional, and business enterprises—unquestionably represented payment for personal services in production. The income of a doctor, for example, or of a farm operator, clearly represents in part, payment for work.

TABLE 1.—*National income by distributive shares, 1955*

Distributive shares	Billions of dollars	Percent
National income	$324	100.0
Compensation of employees	223	69.0
Income of unincorporated enterprises [1]	39	12.0
Rental income	10	3.1
Corporate profits [1]	41	12.6
Net interest	11	3.3

[1] Includes inventory valuation adjustments.

SOURCE: U. S. Department of Commerce.

Most of our national income, therefore, is paid out in return for the productive services of individuals. The mighty stream of labor income includes the wages of the unskilled laborer, the salaries of the corporation president and of the village school teacher, the compensation of the popular entertainer, and the earnings of the automobile salesman. These occupations, which are simply illustrative of the thousands of jobs by which men make their living, offer different rewards in the form of earnings. We now have to look a little more closely at the earnings that occupations yield.

Variations in Rates of Pay

It is necessary to return to the question of rates of pay and to begin to think in terms of a *structure* of rates. A structure of wage or salary rates is simply an array of rates in a company, an industry, or, in a broad sense, in the economy as a whole. It can be thought of as a series of rates designed to compensate workers for the varying skills and abilities required in the production process.

Job Groupings. Some jobs are "worth" more than others. The "worth" of one job relative to another clearly depends largely upon the requirements of the two jobs and upon the number of people available to fill them. The requirements for some jobs are comparatively simple and involve little training or skill or capacity to make decisions. Next, there are very large numbers of jobs that are essentially routine in nature, but that may involve, for example, the operation of particular types of machines or other equipment, the performance of various recordkeeping functions, the exercise of judgment in limited areas, and so on. At the next level are jobs that may involve all-round skill in a particular craft, responsibility for the operation of highly complex equipment, and capacity for decisionmaking within a defined area of responsibility. These three categories of jobs are by no means clear cut; one category tends to shade into another. Taken together, they encompass the bulk of the jobs at which people work. Tending to stand above this structure, but overlapping in terms of pay with the upper end, is the broad range of managerial, professional, and technical jobs.

Since the jobs actually found in industry are so numerous and diverse, it is helpful to think in terms of these few broad classes. Each class should be thought of as containing numerous jobs differing greatly in specific content but roughly similar in their general requirements. The first three classes, taken together, can be viewed as containing the manual and office jobs (literally thousands of occupations) below the supervisory level. Can anything very definitely be said about the range of wage and salary rates within which these jobs fall?

Nonsupervisory Manual and Office Jobs

As of late 1956, the effective range of rates for the great bulk of nonsupervisory manual and office workers in nonfarm jobs was between $1 and $3 an hour. The legal minimum wage for workers covered by the Federal Fair Labor Standards

Act became $1 an hour on March 1, 1956. Under certain conditions, learners and handicapped workers can be paid less than $1, but the legal minimum establishes an effective floor to wage rates for the approximately 24 million workers covered by the act. In industries and employments not subject to the Federal minimum wage law, such as retail trade and most service industries, an appreciable number of workers are paid less than $1. Hence, $1 should be viewed as the bottom of the structure of wage rates only in an approximate sense; some workers will be found at various rates below this level. It should be clear, of course, that the actual minimum rate in many firms and industries is above the legal minimum, in many cases by a substantial amount.

At the upper end of the wage structure, a comparatively small proportion of the nonsupervisory manual and clerical workers earn $3 an hour or more. This group typically includes some of the highly skilled long-service workers in industry; a similar group, usually male, in office employment; some salesmen; and others. The median hourly rate—that is, the rate below and above which half the workers fall—is undoubtedly somewhat below $2 an hour.

This discussion of the range of wage rates for the kinds of jobs at which most of us work may be made clearer and given a touch of realism by table 2. This table shows the actual distribution of plant workers in two industries and of nonsupervisory clerical employees in another by wage rates (or straight-time average hourly earnings). The data in two cases relate to late 1955 and in the third to April 1956. Industrial chemicals is a relatively high-wage industry; plant employment is confined largely to men, many of whom are highly skilled. The table shows that less than one-half of 1 percent of these workers had rates below $1 an hour in August 1955. Since the $1 legal minimum wage did not become effective until March 1, 1956, it is clear that entrance rates in this industry, for the most part, measurably exceed $1 an hour. At the upper end of the wage structure in industrial chemicals, 14.6 percent of the workers earned $2.50 an hour or more; in fact, a few of these workers earned more than $3 an hour. The middle half of the workers had hourly earnings in the range of roughly $1.85 to $2.30 an hour.

The seamless hosiery industry differs in many ways from industrial chemicals. Although the chemical industry is located in all parts of the United States, the manufacture of seamless hosiery is found predominantly in the South. About three-fourths of the workers are women. The proportion of skilled workers is comparatively small. For these and other reasons, the wage structure for plant workers in seamless hosiery differs markedly from that in industrial chemicals.

The most striking fact about the seamless hosiery wage distribution is that in April 1956 (shortly after the $1 minimum wage became effective) about one-fourth of the workers earned exactly $1 an hour and more than two-fifths of the plant workers earned between $1 and $1.10 an hour. The median wage was less than $1.20 an hour. But even in this relatively low-wage industry, a few workers were earning $2.50 an hour or more.

The third distribution relates to nonsupervisory clerical employees of the Bell Telephone companies. In October 1955, there were fairly large groups of employees at each wage level between

TABLE 2.—*Percentage distribution of workers in selected industries, by straight-time average hourly earnings,*[1] *selected dates*

Average hourly earnings[1]	Percentage distribution of—		
	Plant workers, industrial chemicals, August 1955	Plant workers, seamless hosiery mills, April 1956	Nonsupervisory clerical employees, Bell System telephone carriers, October 1955
Under $1.00	0.3	1.9	0.4
$1.00 and under $1.10	.2	43.6	3.6
$1.10 and under $1.20	.6	15.1	7.3
$1.20 and under $1.30	.6	10.9	12.1
$1.30 and under $1.40	1.5	8.0	10.0
$1.40 and under $1.50	3.2	5.9	11.0
$1.50 and under $1.60	4.2	4.4	19.1
$1.60 and under $1.70	4.2	3.6	
$1.70 and under $1.80	7.0	2.2	17.0
$1.80 and under $1.90	9.9	1.5	
$1.90 and under $2.00	11.7	.8	9.7
$2.00 and under $2.10	10.2	.7	
$2.10 and under $2.20	11.0	.4	3.2
$2.20 and under $2.30	8.9	.3	
$2.30 and under $2.40	7.2	.1	2.9
$2.40 and under $2.50	4.8	.1	
$2.50 and over	14.6	.6	3.8
Average hourly earnings	$2.07	$1.22	$1.61
Number of workers	153,647	53,065	120,045

[1] Excludes premium pay for overtime and for work on weekends, holidays, and late shifts.

TABLE 3.—*Distribution of workers[1] by hourly wage rates,[2] selected plant occupations, Philadelphia, Pa., November 1955*

Hourly wage rates[2]	Janitors, porters, and cleaners	Laborers, material handling	Truckers, power (forklift)	Electricians, maintenance	Machinists, maintenance
Under $1.00	483	428			
$1.00 and under $1.10	468	295	1		
$1.10 and under $1.20	489	502	6		
$1.20 and under $1.30	518	481			
$1.30 and under $1.40	892	362	34	6	
$1.40 and under $1.50	676	918	106	4	
$1.50 and under $1.60	945	1, 054	144	15	
$1.60 and under $1.70	1, 055	1, 337	260	2	24
$1.70 and under $1.80	382	1, 805	187	5	54
$1.80 and under $1.90	588	1, 932	297	12	3
$1.90 and under $2.00	60	1, 538	489	98	61
$2.00 and under $2.10	27	298	213	110	92
$2.10 and under $2.20	8	159	71	379	126
$2.20 and under $2.30		20	8	138	202
$2.30 and under $2.40		402	52	208	157
$2.40 and under $2.50		12		207	54
$2.50 and under $2.60				79	113
$2.60 and under $2.70				62	160
$2.70 and under $2.80				148	148
$2.80 and under $2.90				43	14
$2.90 and under $3.00				21	1
$3.00 and over				62	44
Average hourly rates	$1. 43	$1. 65	$1. 83	$2. 35	$2. 37
Number of workers	6, 591	11, 543	1, 868	1, 599	1, 253

[1] Data relate only to men.
[2] Excludes premium pay for overtime and for work on weekends, holidays, and late shifts.

TABLE 4.—*Distribution of workers by weekly salary rates, selected office occupations, Philadelphia, Pa., November 1955*

Weekly salary rates	Office boys	Bookkeeping-machine operators, class B (women)	Typists, class B (women)	Stenographers, general (women)	Accounting clerks, class A (men)
$30.00 and under $35.00	93		75		
$35.00 and under $40.00	214	125	641	101	
$40.00 and under $45.00	266	453	1, 338	405	
$45.00 and under $50.00	88	523	936	685	2
$50.00 and under $55.00	99	381	645	897	4
$55.00 and under $60.00	26	187	284	807	20
$60.00 and under $65.00	7	122	134	670	70
$65.00 and under $70.00	1	44	46	536	64
$70.00 and under $75.00	7	19	39	250	61
$75.00 and under $80.00		22	2	104	86
$80.00 and under $85.00		5	5	63	66
$85.00 and under $90.00		5		13	69
$90.00 and under $95.00				14	64
$95.00 and under $100.00				10	42
$100.00 and under $105.00					38
$105.00 and under $110.00					27
$110.00 and under $115.00					12
$115.00 and under $120.00					7
$120.00 and over					14
Average weekly salaries	$42. 00	$49. 00	$46. 00	$56. 50	$82. 50
Number of workers	801	1, 886	4, 145	4, 556	646

$1.10 and $2 an hour. Less than one-half of 1 percent of the clerical staff earned less than $1 an hour; at the upper end, 3.8 percent earned $2.50 or more.

Additional light is thrown on the question of earnings in nonsupervisory manual and white-collar jobs by tables 3 and 4. Table 3 shows the distribution of workers by wage rates for 3 relatively unskilled and for 2 skilled plant jobs in the Philadelphia, Pa., labor market in November 1955. The average hourly rates for these jobs ranged from $1.43 for janitors and porters to $2.37 for maintenance machinists. It will be observed that there was a considerable range of rates for each of these jobs. For the great bulk of the workers, rates fell between the limits we have been discussing—$1 to $3—with comparatively small proportions of the unskilled workers receiving less than $1 and of the skilled workers receiving more than $3. The higher wage rates for unskilled jobs overlap the lower wage rates for skilled occupations. Thus, although the average for laborers was 70 cents less than the average for electricians, the highest paid groups of laborers received more than the lowest paid groups of electricians.

Table 4 shows the same type of information (in the form of weekly salary rates) for selected office jobs in the Philadelphia area. Again a considerable range of rates for each job is indicated. Again the salaries for different jobs overlap. General stenographers, on the average, earned about $10.50 more a week than routine typists, but some typists earned as much or more than some stenographers. The weekly salary rates of skilled accounting clerks in a few cases exceeded $120 a week; i. e., $3 an hour on a 40-hour week basis. The salaries of most office boys ranged between $35 and $45 a week.

The fact that there is typically a range of rates for the same job in the same labor market, rather than a single rate, need occasion no surprise. One reason is that individuals doing the same type of work differ in their productive capacity, so that differences in rates reflect, to some extent, variations among individuals. Rough recognition is given to this factor in many firms by the establishment of a range of rates for each job, with progression within the range depending on merit, length-of-service, or both. Another factor is that the duties or conditions attached to a job may not be exactly the same among firms or even within a firm. For example, rates paid to laborers engaged in loading and unloading materials may vary somewhat depending on the type and weight of the materials being handled, whether the job is performed indoors or outdoors, and on other job conditions. It must be recognized, finally, that wage rates at any one time may differ among firms or industries, even in the same geographic area. As previously noted, the average rate for janitors and porters in the Philadelphia area in November 1955 was $1.43 an hour; their average rate varied from $1.08 in service industries to $1.65 in public utilities. This spread may be accounted for in part by variations in job duties or conditions of work, but it may also reflect a difference in wage level between these two types of industry.

A Note on Wage Differentials. The wage rate structure for nonsupervisory manual and office jobs tends to be confined, as we have seen, to the area between $1 and $3 an hour. A plant or an office will have a hierarchy of jobs with rates ranging broadly within these limits. Jobs requiring comparatively little skill or responsibility or training will carry the bottom rates in the wage or salary structure; the higher steps in the pay ladder will be attached to jobs requiring greater responsibility and skill.

What is the extent of the monetary reward—there may well be other rewards and satisfactions as well—for moving up the job ladder? Studies by the Bureau of Labor Statistics have revealed a long-run tendency for pay differentials for plant jobs to decline. In 1907, the skilled plant worker, on the average, earned slightly more than double the unskilled worker's rate. By 1947, this differential had declined to approximately 50 percent, and there was apparently some further narrowing up to about 1953. During the past several years, the tendency for skill differentials to narrow has been arrested, if not reversed, and it seems probable that increasing attention will be given to the question of appropriate pay differences among jobs.

An analysis by the Bureau of Labor Statistics of pay differentials in major labor markets, based on 1955–56 data, indicates that tool and die makers, a highly skilled plant occupation, had an average (median) rate of 56 percent above that for janitors. The fact must be emphasized that this is an average; indeed, the wage rate differential in favor of tool and die makers ranged from

47 to 70 percent among the middle half of the plants included in the study. Median wage differentials for other skilled plant maintenance workers ranged from 36 percent above the janitor rate for painters and millwrights to 48 percent for plumbers.

Several factors relating to labor supply appear to account for the long-run tendency for wage differentials to decline. One is the restriction of immigration after World War I, which had the effect of reducing the supply of unskilled labor. Another factor is found in the rising educational level of the working population; relatively fewer people are available for unskilled jobs and a greater proportion for more skilled occupations. Moreover, technological change has altered the nature of many "unskilled" jobs. The janitor, for example, may now operate scrubbing machines, polishers, and the like, which enhance his output and provide a basis for higher wages. Another factor has been the tendency in collective bargaining for relatively greater wage increases to be negotiated for the lower paid and less skilled workers.

One consequence of this complex of forces has been some apparent alteration in the position of office employees as compared with manual workers. Even in the more routine jobs, office workers at one time received not only higher pay, on the average, than unskilled plant workers, but tended also to receive more in the way of "fringe" benefits, such as paid vacations and holidays. In recent years, this latter advantage has been sharply reduced. In terms of pay, the study referred to indicated that skilled male accounting clerks occupied about the same pay position as maintenance painters, automotive mechanics, and pipefitters. Men payroll clerks and tabulating-machine operators generally ranked with truckdrivers. Stenographers and material handling laborers shared approximately the same pay position.

Other Types of Differentials. The American wage structure for nonsupervisory manual and office jobs, and for many other types of jobs as well, is characterized by a variety of differentials that appear broadly to be related to such factors as industry, size of firm, and location. This is an extraordinarily complex subject and cannot be explored here. Available wage statistics do suggest, however, that some industries offer higher wages than others for comparable jobs; that wages tend to be higher in large firms than in small; that rates of pay tend to vary directly with size of community; and that wages, especially for plant jobs requiring little skill, tend to be lower in the South than in the rest of the country. Many qualifications need to be attached to these generalizations, but they are descriptive of broad conditions reflected in the wage structure.

Supervisory and Professional Occupations

It has been established that the wage or salary rates for most nonsupervisory manual and office jobs ranged between $1 and $3 an hour as of late 1956. Assuming full-time employment (say 2,080 hours annually), these rates yield from $2,080 to $6,240 a year. How do salaries for supervisory, technical, and professional occupations compare with this range of annual earnings?

It is clear, in the first place, that there is considerable overlap between the upper end of the wage structure for manual and clerical jobs and the lower end of the structure for supervisory, technical, and professional occupations. This is particularly true with respect to a number of professional occupations in which large numbers of workers are employed on a salaried basis. For example, a survey by the American Federation of Teachers indicates that in the academic year 1955–56, the average minimum (or entrance) salary for public school teachers with A. B. degrees in cities of 10,000 population and over was $3,263. The average maximum salary, reached over a period of years, was $4,915. The lowest minimum reported was $2,000 (in a small number of communities) and the highest maximum, $7,050 (New York City). Salary rates for holders of M. A. degrees were generally somewhat higher. Librarians, dietitians, and registered nurses are examples of other professional groups with average earnings falling within the upper half of the manual-worker office-employee range. The average salary rate for senior draftsmen, a technical occupation, approximates the average rate for tool and die makers, a top skilled manual job.

In many instances, professional and supervisory functions may be combined, and rate progressions tend to reflect this fact. In the Federal Civil Service, for example, professional employees are largely distributed among 11 grades, each with a salary range. The range for the entrance grade, as of 1956, was $3,670–$4,480 annually, and for the

top grade, \$11,610–\$12,690. Professional employees in the higher grades almost invariably perform a variety of administrative and supervisory functions related to their professional duties. The same situation undoubtedly exists, although perhaps to a lesser extent, among professional employees in industry.

Rates of remuneration for salaried professional personnel tend to be fixed within limits that can usually be roughly defined. The annual salaries of most professional workers appear broadly to fall between about \$4,000 and \$12,000, depending on the occupation, age, education, and abilities of the individual, and on a variety of other factors, such as geographic location, that affect salary rates. Some salaried professional employees earn substantially more than the upper limit of this indicated range, and the earnings of some are less than the lower limit would suggest.

The range of earnings among self-employed professional workers—doctors, dentists, lawyers, architects, and the like, engaged in independent practice—is clearly much greater than among salaried professional employees. The upper end of the range is higher. The independent practice of a profession contains an element of risk; Adam Smith, more than 150 years ago, compared the professions to a lottery in which many fail and a few gain great prizes. This comparison may have been something of an exaggeration in Adam Smith's time; it is certainly so today. The great prizes remain; they provide one of the incentives for those who undergo the training required for a professional career. There are failures. The odds against success are greater in some fields than in others—professional entertainers, for example, as compared with medical doctors—and the top prizes seem correspondingly greater. This is only another way of saying that opportunity and chance play greater roles in some fields than in others. In some professions—medicine is an example—an individual in independent practice, if he has reasonable competence and capacity for work, has a very high chance of achieving success in terms of income. In 1949, according to the Bureau of the Census, 41 percent of the male physicians and surgeons, predominantly self-employed, earned \$10,000 or more as compared with only 5.1 percent of college presidents, professors, and instructors.

Rates for supervisory jobs in industry vary enormously, largely because of the great differences in the duties and responsibilities associated with such positions. A foreman (the first level of supervision in a plant) may be responsible for the work of half a dozen men, and his pay may be closely related (say 10 percent higher) to the wages of the men he supervises. The responsible head of the enterprise may be paid 10 or 20 times as much, perhaps even more. A man reaches a higher level supervisory and administrative job typically only over a considerable period of time in which his capacity can be tested. As in most areas of human activity, chance sometimes plays a part.

Wage or Salary Income, 1955

General Distribution of Workers by Wage Income. Having tried, in a very rough way, to indicate the range of wage or salary rates paid for human effort in production, we can now look at some general statistics of income from wages and salaries as developed by the Bureau of the Census. These data relate to 1955. Table 5 shows the dis-

TABLE 5.—*Percentage distribution of year-round, full-time workers 14 years of age and over by wage or salary income* [1] *and by sex, 1955*

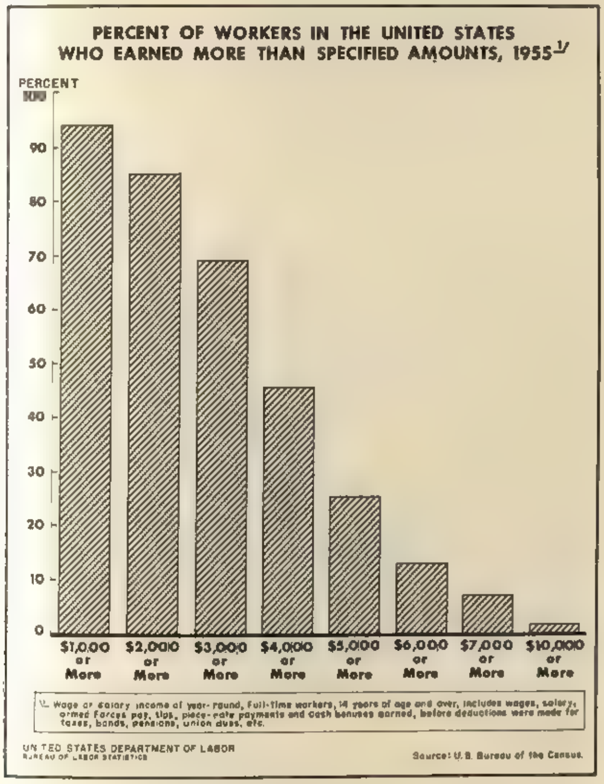
Wage or salary income	Men and women	Men	Women
\$1 to \$499	3. 1	3. 3	2. 5
\$500 to \$999	2. 8	2. 0	5. 0
\$1,000 to \$1,499	3. 5	2. 4	6. 8
\$1,500 to \$1,999	5. 4	3. 3	11. 8
\$2,000 to \$2,499	7. 9	4. 8	17. 1
\$2,500 to \$2,999	8. 2	5. 9	15. 5
\$3,000 to \$3,499	12. 3	10. 2	18. 8
\$3,500 to \$3,999	11. 3	11. 4	10. 9
\$4,000 to \$4,499	11. 5	13. 3	6. 1
\$4,500 to \$4,999	8. 6	10. 9	1. 8
\$5,000 to \$5,999	12. 4	15. 7	2. 3
\$6,000 to \$6,999	5. 9	7. 6	. 8
\$7,000 to \$9,999	5. 4	7. 0	. 6
\$10,000 to \$14,999	1. 2	1. 6	. 1
\$15,000 to \$24,999	. 3	. 4	--------
\$25,000 and over	. 1	. 2	--------
Total	100. 0	100. 0	100. 0
Q_1 (First quartile)	\$2, 640	\$3, 162	\$1, 953
Median	3, 801	4, 252	2, 719
Q_3 (Third quartile)	5, 032	5, 478	3, 434

[1] Wage or salary income includes wages, salaries, Armed Forces pay, commissions, tips, piece-rate payments, and cash bonuses earned before deductions were made for taxes, bonds, pensions, union dues, etc.

SOURCE: U. S. Bureau of the Census.

tribution of full-time workers by wage or salary income for the country as a whole. The table relates only to persons who worked as employees for wages or salaries; it excludes self-employed professional and other workers. Chart 15 is derived from the first column of the table.

CHART 15



There are several observations to be made with respect to table 5. The median income from wages and salaries in 1955, taking men and women together, was $3,801. This is clearly well within the range of rates of $1–$3 per hour indicated earlier as applicable to most nonsupervisory plant and office workers jobs and to many salaried professional workers. The median for men was $4,252 and for women $2,719. This difference between the average level of income from wages and salaries for men and women was, in considerable measure, a reflection of differences in the occupations in which they were employed. It will be noticed that the lower 25 percent of the workers (this is what the "first quartile" means), both sexes combined, earned less than $2,640 and the upper 25 percent (the "third quartile") earned more than $5,032. Only about 1.6 percent of the wage and salaried workers earned $10,000 or more.

The lower end of the distribution (3.1 percent of the workers are shown as receiving less than $500 in wage and salary income) is heavily affected by the inclusion of "year-round, full-time workers," such as farmers who received some income from wages but the bulk of whose income was derived from other sources (for example, the net proceeds from the sale of farm produce).

Average Wage Income by Industry. Table 6 shows median (average) income from wages or salaries in selected major industry groups in 1955. Median income for men ranged from $3,801 in professional and related services to $4,875 in finance, insurance, and real estate—a spread of almost $1,100. The comparatively low average for professional and related services may seem surprising, but it must be remembered that the earnings of self-employed workers are not included in the table. Thus, a legal office might consist of a lawyer, a clerk, and two stenographers; the net earnings of the lawyer would not be considered part of wage and salary income.

TABLE 6.—*Median wage or salary income [1] of year-round, full-time workers 14 years of age and over by selected major industry group and by sex, 1955*

Major industry group	Median income	
	Men	Women
Construction	$4, 257	--------
Manufacturing	4, 508	$2, 876
Transportation, communication, and other public utilities	4, 398	---
Wholesale trade	4, 352	---
Retail trade	4, 031	2, 127
Finance, insurance, and real estate	4, 875	3, 038
Business and repair services	3, 985	----
Professional and related services	3, 801	2, 955
Public administration	4, 452	3, 437

[1] See footnote 1, table 5.

SOURCE: U. S. Bureau of the Census.

Median salaries for women among the 5 industry groups for which information is shown in table 6, ranged from $2,127 in retail trade to $3,437 in public administration.

Average Wage Income by Major Occupational Group. Table 7 shows median income in 1955 from wages and salaries for men and women in eight broad occupational groups. It also shows the first quartile—the income below which the lowest one-

TABLE 7.—*Wage or salary income*[1] *for year-round, full-time workers, by selected major occupation group and by sex, 1955*

Selected occupation group	Men			Women		
	First quartile	Median	Third quartile	First quartile	Median	Third quartile
Managers, officials, and proprietors, except farm	$4, 163	$5, 584	$7, 910			
Professional, technical, and kindred workers	4, 063	5, 382	6, 792	$2, 828	$3, 500	$4, 347
Sales workers	3, 782	4, 937	6, 636			
Craftsmen, foremen, and kindred workers	3, 821	4, 712	5, 707			
Clerical and kindred workers	3, 486	4, 162	4, 901	2, 451	3, 065	3, 568
Operatives and kindred workers	3, 097	4, 046	4, 870	2, 024	2, 489	3, 220
Service workers, except private household	2, 605	3, 565	4, 292	1, 240	1, 759	2, 332
Laborers, except farm and mine	2, 143	3, 105	3, 947			

[1] See footnote 1, table 5.

SOURCE: S. U. Bureau of the Census.

quarter of the workers fell, and the third quartile, the income above which the highest one-quarter of the workers fell. The middle half of the workers in each occupational group had incomes between the two quartiles (the interquartile range). The data are set forth in graphic form in chart 16.

For male workers, the highest averages, as might be expected, were for the managerial group ($5,584) and for professional and related workers ($5,382); the lowest median wage ($3,105) was for laborers. It will be noticed that the middle range for managers and officials ($4,163–$7,910) was markedly wider than the interquartile range for laborers ($2,143–$3,947). This reflects in part the much greater range of specific occupations found in this group, as well as the greater tendency for salaries to advance with age and experience. The median wage for salesmen was not much higher than for craftsmen, foremen, and kindred workers, but their interquartile range was much wider.

In the 4 occupational groups for which data for women are shown, median salaries ranged from $1,759 for service (except private household) workers to $3,500 for professional, technical, and kindred workers.

An important point brought out by chart 16 and table 7 is the wide range of wage and salary income within each group of occupations and the overlapping among the groups. For example, although the median earnings of craftsmen were nearly $700 more than the median for operatives, the highest paid one-quarter of the operatives earned more than the lowest paid half of the craftsmen.

Income Related to Age and Education. Table 8 is designed to show in a general way the relationship of income to age and educational attainment.

TABLE 8.—*Median income of men and women by selected age groups and educational attainment, 1949*

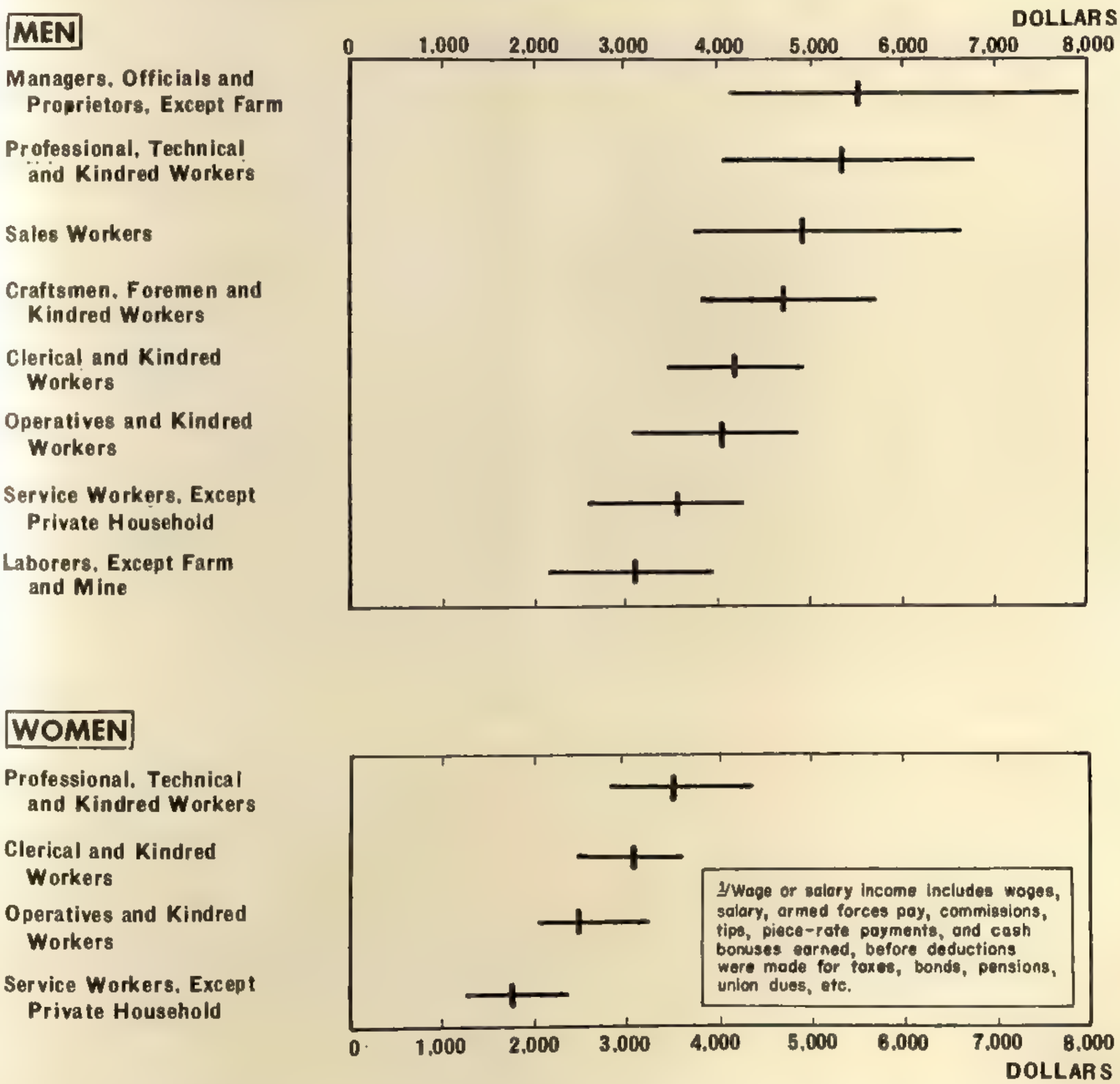
Educational attainment	25–29 years	30–34 years	35–44 years	45–54 years	55–64 years
	Men				
8 years of schooling	$2, 255	$2, 557	$2, 803	$2, 912	$2, 601
High school graduates	2, 892	3, 308	3, 523	3, 687	3, 436
College graduates	2, 928	4, 227	5, 142	5, 549	5, 142
	Women				
8 years of schooling	$959	$1, 067	$1, 193	$1, 171	$942
High school graduates	1, 626	1, 587	1, 719	1, 799	1, 472
College graduates	2, 098	2, 207	2, 470	2, 668	2, 591

SOURCE: U. S. Bureau of the Census.

CHART 16

WAGE OR SALARY INCOME FOR THE MIDDLE HALF OF YEAR-ROUND, FULL-TIME WORKERS

By Selected Major Occupational Group and Sex, 1955 1/



NOTE: The lower end of each bar marks the "lower quartile". One-quarter of the workers in the major occupational group earned less than this amount.

The mark between the upper and lower end of each bar shows the median. Half of the workers in the major occupational group earned more than this amount and half earned less.

The upper end of each bar marks the "upper quartile". One-quarter of the workers in the major occupational group earned more than this amount.

UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Source: U. S. Bureau of the Census

The data relate to 1949. It will be observed that, for men, there is no sharp difference in average income at ages 25–29 as between high school and college graduates; average income for those with only 8 years of schooling, however, is considerably below the level of those with greater education. Thereafter, income tends to increase with age up to the 45–54 year age bracket—and increases faster for those with the most education. Men with 8 years of schooling had average income in the 45–54 year age group of 29 percent above those in the 25–29 year age bracket; the corresponding percentage for high school graduates was 27. For college graduates, however, the increase was 90 percent. Another way of putting it is that among the 45–54 year age group, male college graduates in 1949 had average incomes 91 percent above those with 8 years of schooling and 51 percent above high school graduates.

Among women, there is a very decided difference in average income at the 25–29 year age level for those with only 8 years of schooling and either high school or college graduates. Thereafter, income increases moderately among women high school and college graduates up to the 45–54 year age bracket and up to the 35–44 year group for those with 8 years of schooling. These moderate increases, as compared with those for men, suggest that women as a group have more limited opportunities for job choice and advancement.

Money, Real Income, and Economic Progress

This brief discussion of income from work has been couched mainly in terms of money income. It is in this form that wage and salary rates are quoted and that income is received. Money income is useful, however, largely for the command it affords over goods and services—for the purchasing power it represents. The goods and services that people buy with their money incomes represent *real* income, and it is real income that determines the standard of living that a people can enjoy.

Real income and living standards tend to rise when production per head increases. Increased productivity can be reflected in higher money incomes or lower prices or both. Rising productivity is evidence of economic progress. It results from technological improvements as embodied in new machinery and other forms of capital equipment, from scientific research that yields new products or better products, and from the more effective application of labor in production. The rising educational level of the American labor force is a key factor in economic progress.

Professional, Administrative, and Related Occupations

Professional and administrative occupations have many attractions for young people considering the choice of a career. These occupations offer opportunities for interesting and responsible work, lead to relatively high earnings, and are at the top of the ladder in prestige. However, they can, as a rule, be entered only after long periods of education and training, since a broad knowledge of one's field and judgment of a high order are outstanding requirements for success in these types of work.

Professional and Related Occupations

Professional occupations are of two main types. The largest group of professions—including those of engineer, architect, physician, lawyer, and teacher—are concerned with developing or applying well-organized fields of knowledge. The others, such as editor and actor, do not require as much specialized, theoretical knowledge, but demand a great deal of broad background knowledge or creative talent, and skill acquired chiefly through experience. Generally, the professions require either college graduation—often with an advanced degree—or experience of such kind and amount as to provide a comparable background. Licenses are required for practice in many professions—medicine, dentistry, and pharmacy, for example; in these professions, the licensing authorities determine the minimum qualifications which members must have. Professional societies also set up standards for membership, which tend to define their respective fields. In many areas of work, however, there is no clear-cut line between professional and other classes of workers.

When high school students are asked what kind of work they want to go into, a large proportion of them list professional occupations. This is partly because the professions have prestige and partly because many young people do not know enough about the opportunities for interesting jobs as technicians or craftsmen or in other nonprofessional occupations.

It is not easy to prepare for and enter professional work. For most professions, one must complete a long period of training and hard study in competition with the very brightest students. In many cases, one must pass difficult examinations in the colleges and professional schools and before State licensing boards. Often, applicants are not accepted for professional training unless their school grades are high, and employers generally give preference in hiring to graduates whose grades in professional school put them high in their class.

Besides the professions, there are a variety of technical occupations which also require considerable training, although less than is needed for professional positions. People in these occupations work with engineers, scientists, physicians, and other professional personnel. Their job titles include, for example, those of draftsman, engineering aid, and electronic, laboratory, or X-ray technician. Employment as a technician requires a combination of basic scientific knowledge and manual skill, which can be obtained through about 2 years of post high school education, such as is offered in many technical institutes and junior colleges, or through equivalent on-the-job training. Many of the duties of technicians may be performed also by beginning professional workers. However, because of their more limited educational background, technicians generally find it much more difficult to advance to high-level positions than do professional workers.

The major professional, technical, and related occupations are shown in chart 17. Teaching, engineering, nursing, and accounting—each employing more than 375,000 persons—were, by far, the largest professional occupations in 1950. Among technicians, draftsmen were the largest group.

Employment Trends

The professions and closely related occupations are one of the fastest growing groups of occupations in the country. From less than half a million in 1870, the number of professional, technical, and related workers rose to over 6 million in early 1956. This was a 17-fold increase—a rate of growth 3 times as fast as that of the whole labor force. Professional employment rose during each of the eight decades since 1870 (chart 18). It

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CHART 17

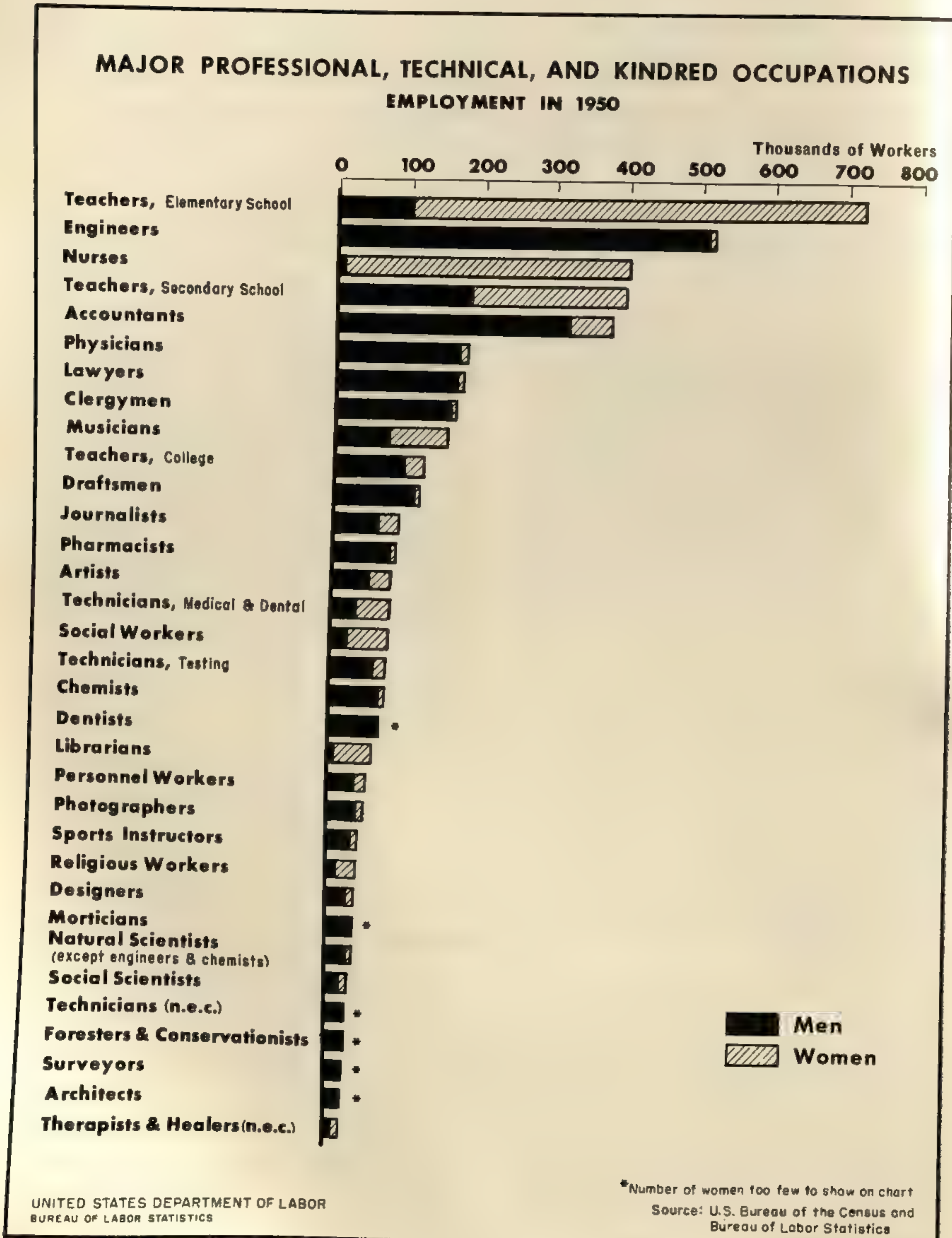
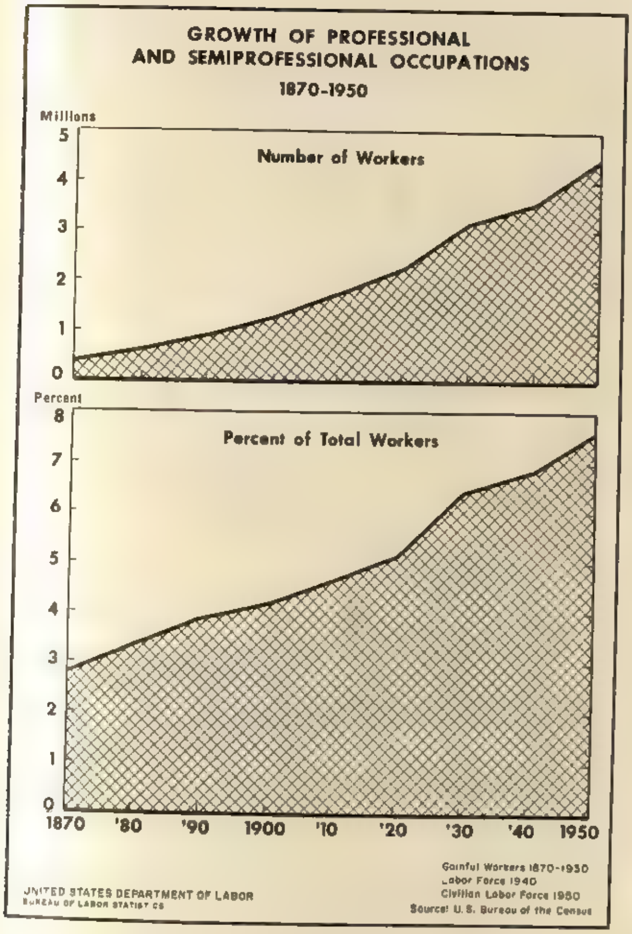

MAJOR PROFESSIONAL, TECHNICAL, AND KINDRED OCCUPATIONS
EMPLOYMENT IN 1950
Thousands of Workers
0
100
200
300
400
500
600
700
800
Teachers, Elementary School
Engineers
Nurses
Teachers, Secondary School
Accountants
Physicians
Lawyers
Clergymen
Musicians
Teachers, College
Draftsmen
Journalists
Pharmacists
Artists
Technicians, Medical & Dental
Social Workers
Technicians, Testing
Chemists
Dentists
Librarians
Personnel Workers
Photographers
Sports Instructors
Religious Workers
Designers
Morticians
Natural Scientists (except engineers & chemists)
Social Scientists
Technicians (n.e.c.)
Foresters & Conservationists
Surveyors
Architects
Therapists & Healers (n.e.c.)
Men
Women
*Number of women too few to show on chart
Source: U.S. Bureau of the Census and Bureau of Labor Statistics
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

CHART 18



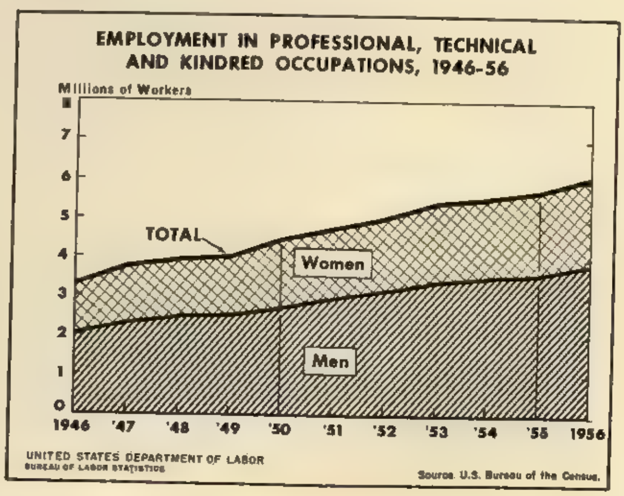
grew especially fast during the prosperous 1920's and more slowly during the depression years of the 1930's and the war years of the early 1940's. Since World War II, employment in the professions has again risen rapidly (chart 19).

A major reason for the increase in the total number of workers in professional and related occupations has been the development of new professional fields. In 1870, the leading professions were the traditional ones of medicine, the ministry, law, and teaching. Nearly 75 out of every 100 professional workers were in these occupations, compared with only about 40 out of 100 today.

The "big four" professions of 1870 have all grown considerably since that time. By 1950, the medical profession employed 3 times as many people as 80 years before, the ministry and the legal profession each employed about 4 times as many, and teaching about 10 times as many. However, the number of people in scientific, engineering, and closely related professions was nearly 100 times greater in 1950 than in 1870—a growth which has both contributed to and resulted from the rapid development of science and engineering during the past century. Other major professions, not recognized as separate occupational fields in 1870, have also developed—for example, social work, accounting, and personnel work. The growth of these professions is related to the initiation of extensive private and public programs in the field of social welfare and also to the need for specialists to deal with problems arising out of the increasing complexity of economic life and the growing size of business and Government organizations. The basic reasons for the development of new professions are, thus, the extension of scientific knowledge and the more complex organization of society and of work. The trend toward subdivision of professional fields into more and more specialties is a continuing one, and many professions are still in the early stages of development.

Along with the expansion in scientific and engineering professions, there has been rapid growth also in technical occupations. In the single decade 1940 to 1950, for example, employment of industrial technicians increased by 150 percent. As scientific and technical work has become more highly organized, particularly in the laboratories and engineering departments of large firms and in Government agencies, more technical assistance has been provided for the professional workers. During World War II, when severe shortages of engineers and scientists developed, it was discovered that part of the work formerly done by these

CHART 19

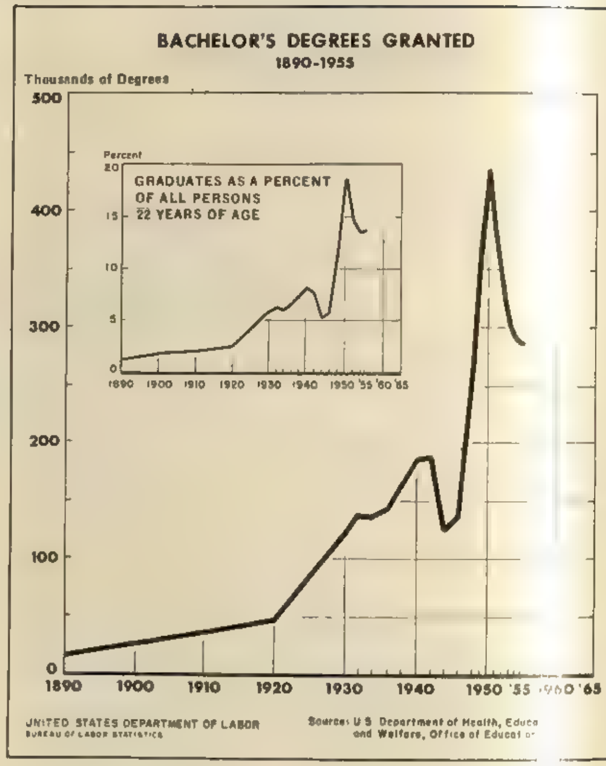


professional workers could be handled by men with less training, thus freeing the professional personnel for the more difficult tasks. In the postwar period, with continuing shortages of engineers and scientists, industries have hired more technical assistants and probably would have taken on a still greater number had it not been for the shortages of personnel which existed also in these technician occupations.

The growth of the professions has brought with it a great increase in the number of women as well as of men professional workers. In 1956, 36 percent of all professional and related workers were women, compared with 27 percent in 1870. Women professional workers are still concentrated in a few fields—above all, teaching and nursing. However, in fields such as engineering and the sciences, where there have been personnel shortages in recent years, women have been finding increasingly favorable employment opportunities.

Since the reasons for the growth of the professions are deeply rooted in our dynamic economy and technology, there is every reason to look forward to continued expansion in professional employment in future years. However, there will naturally continue to be differences in the rate of growth among professions, as is indicated in the statements on most of the major professions in following chapters.

CHART 20



Educational Trends

The growth of the professions has been accompanied by a great increase in the numbers of young men and women graduating from college—who are, of course, the chief source of professionally trained workers. In 1890, only about 1 out of every 100 young people of college age completed a college course, and this proportion increased only slightly during the following 30 years. After 1920, however the proportion of young people completing college began to rise rapidly; by 1940, it was 8 percent and by 1956, more than 13 percent, as shown in the inset in chart 20. (The high level reached in 1950 is artificial, reflecting the large number of veterans who went to college under the veterans education program and who, in many cases, would have completed college earlier if it had not been for the war.)

The recent rapid increase in the proportion of young people graduating from college reflects a number of basic social trends. Family incomes are higher, and more people can afford to put off going to work and to pay the costs of education. More families want a college education for their children. Scholarships and loans are available for more students; part-time work opportunities are also available, particularly in times of labor shortages. Finally, a college education is becoming necessary for an increasing proportion of jobs. In the professions, which are continuing to grow in size and importance, a college education has largely supplanted on-the-job training as a way of preparing for professional employment. Moreover, employers are giving preference to college-educated workers for more and more administrative, sales, and other nonprofessional positions. Since these factors will probably continue to be influential in the future, the proportion of young people who graduate from college is expected to go on increasing for many years.

The population of college age is also growing. The number of people aged 18 to 21 dropped to a low point of 8.5 million in 1953, as a result of low depression-year birthrates. Thereafter, the 18–21-year-old population began to increase. By 1960, it will be 9.6 million, 13 percent higher than in 1953; by 1965, 12.1 million, 43 percent higher;

and by 1970, 14.5 million, or 71 percent higher.

All this adds up to a great expansion in college graduations, assuming that the Nation's colleges and universities can build the classrooms, laboratories, dormitories, and other facilities and hire the faculty members needed to provide for the greatly increased numbers of students. If past trends continue, it is likely that the number of bachelor's degrees awarded annually will be more than double the current figure by the late 1960's. The rise, which is expected to be gradual during the remainder of the 1950's, will be accelerated in the early 1960's, and may be spectacular in the last years of the 1960 decade. Projections prepared by the U. S. Office of Education in March 1956 indicate an increase from 311,000 bachelor's degrees granted in 1956 to 437,000 in 1960, to 567,000 in 1965, and to 766,000 in 1970.

The number of students taking graduate training has also risen very rapidly during past decades, and will probably continue to mount in the years ahead. Graduate education means, of course, continuing study in a university after one has received the bachelor's degree, which is usually earned at the end of 4 years of college. The major graduate degrees are the master's degree (M. A., M. S., etc.)—usually earned through 1 or 2 years of study beyond the bachelor's degree—and the doctorate (Ph. D., D. Sc., Ed. D., etc.), usually requiring 3 or more years beyond the bachelor's degree. Graduate study is usually concentrated in the major subject field of the student's interest, whereas undergraduate study is usually broader in content.

Charts 21 and 22 show the tremendous increase in graduate degrees awarded since 1920 in all fields taken together. The numbers of master's and doctor's degrees granted reached unprecedented heights in the early 1950's, following the record number of bachelor's degrees granted a few years before. After a slight decline in the mid-1950's, master's degrees are expected to rise from about 58,000 in 1955 to more than 100,000 in 1965, if past trends continue. The number of doctorates awarded (8,800 in 1955) may also nearly double in the same 10-year period. According to projections made by the U. S. Office of Education, the number of master's degrees conferred may exceed 160,000 and doctorates may approximate 20,000 in 1970.

These projections obviously imply a great increase in the supply of personnel available for professional employment. Since the demand for personnel is also expected to show continued

CHART 21

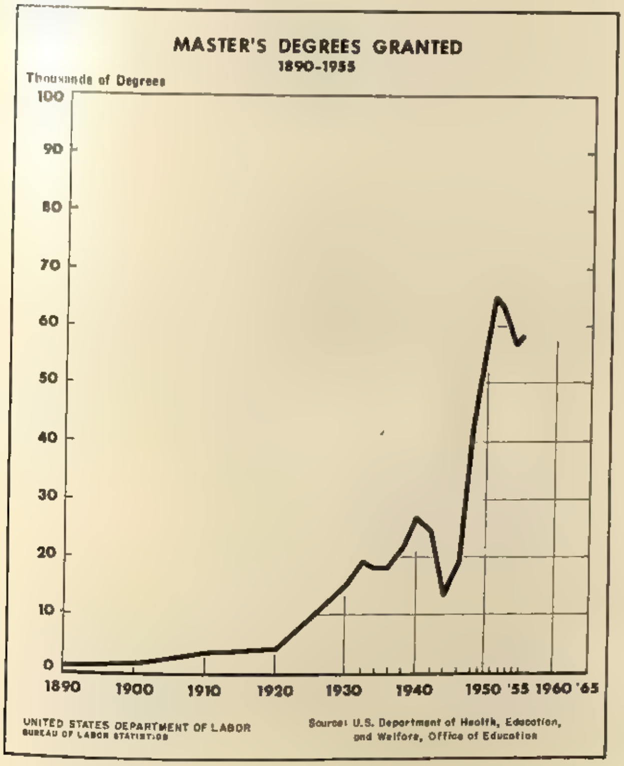
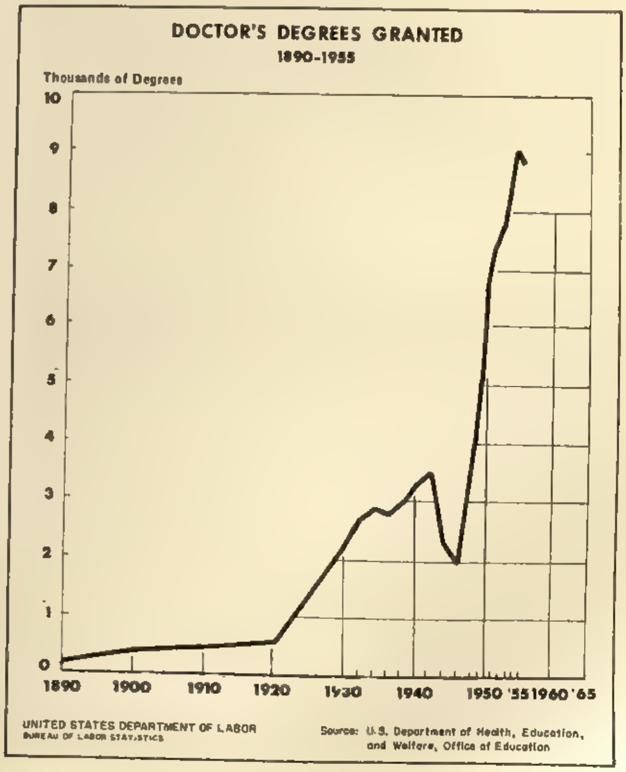


CHART 22



growth, there is promise of expanding employment opportunities for the increasing numbers of college graduates. The anticipated increases in college-trained personnel raise the possibility, however, of increasing competition during the 1960's for the better professional positions in at least some fields of work, as indicated in the statements on the various fields in following chapters.

Young people interested in entering a profession should consider the trend toward requiring more and more educational preparation for professional positions, which is likely to be reinforced as more college-trained workers become available. The extension of educational requirements for professional work has been due basically to the growing complexity of the various fields of science and other professions, which has lengthened the period of education and on-the-job training required for mastering the field. However, the increase in college graduations has also contributed to the trend; as more workers with graduate degrees become available, such degrees become increasingly important in competing for employment in the fields. It is believed that these trends will continue—that employers will require college education as a minimum qualification for more and more different occupations or, at least, will give preference to people with such education; also that an increasing amount of graduate education will be required by employers or State boards of licensure in some occupations for which college training is already a prerequisite.

Administrative and Related Occupations

Men and women in administrative and managerial work hold many different types and grades of positions. Their positions range from that of proprietor of a small business, such as a lunch counter or corner grocery store, to that of president of a giant corporation.

Altogether, about 6.5 million people—including about 1 million women—were working as proprietors, managers, and officials in 1956. Proprietors of business firms—most often retail stores—represented about half of all persons in this field of employment. Salaried officials of business firms made up the second largest group. However, there are also several hundred thousand administrative workers in Federal, State, and local government agencies and in nonprofit organizations of many kinds.

Types of Administrative and Managerial Jobs

Jobs in business management can be grouped in several broad classes. At the top are the general administrators of large companies—the persons who set broad policies and who have overall responsibility for the operation of the company or a major segment of its activities. Included in this group are such top officials as presidents, vice presidents, general managers, division superintendents, and men with similar titles. These top executives make plans, set policies, and supervise company operations in a general way.

Below the top officials are the administrative personnel—such as plant managers, comptrollers, sales managers, purchasing agents, credit managers, and buyers in stores—who direct individual departments or special phases of a firm's operations. In very large corporations, officials in charge of these functions have great responsibility and are often considered part of the top management.

The duties and responsibilities of the managers of small firms are obviously quite different from those of officials of large corporations. In the smallest businesses, the proprietor acts as his own general manager, sales manager, buyer, and bookkeeper. He may supervise his workers directly and deal directly with customers. In some types of owner-operated businesses—for example, neighborhood bakeries, shoe repair shops, and small printing shops—knowledge of the particular trade or technical process counts as much towards success as does managerial ability. Nevertheless, the pressure of competition is making a knowledge of business administration methods increasingly necessary for proprietors and managers of small businesses.

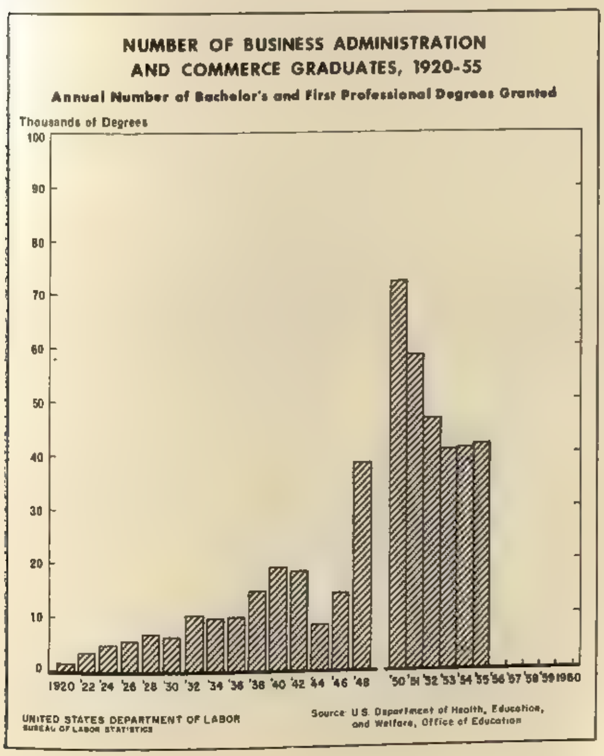
Training for Administrative Jobs

Business administration has been known traditionally as a field in which men of outstanding ability and energy could rise without the aid of a college education. This is still true to a considerable extent, especially in small business. Each year, thousands of persons without college training find opportunities to establish and manage

their own business enterprises. Furthermore, in large firms some outstanding employees who are not college graduates continue to move upward into executive jobs. However, advancement to administrative positions is becoming much more difficult for such individuals. To a steadily increasing extent, companies are hiring business administration majors or other college graduates as executive trainees and filling administrative positions by promotion of these trainees or of professional personnel such as engineers or accountants. Even for college-trained employees promotion to administrative jobs normally requires many years of experience, and only a few outstanding individuals can hope to achieve top level positions.

To prepare students for managerial jobs in industry, colleges and universities have set up special courses of study in business subjects. Such training programs are a relatively recent development, with only a few in existence before 1900. After 1920, as shown by chart 23, the number of students graduating from business administration courses increased very rapidly—from 1,500 in 1920 to 19,000 in 1940. A temporary drop in business enrollments and graduations during World War II was followed by a remarkable upsurge after V–J Day. The tremendous flow of veterans

CHART 23



and other students into business courses was reflected in the record number of business and commerce graduates in 1950 (72,000). In 1955, after the veterans education program tapered off, there were 42,000 graduates of such courses, many more than before the war. Business education is now second only to teacher training as a field of college education; graduates with majors in business administration outnumber those in such large fields as engineering, law, and medicine.

In all probability, the number of business administration graduates will continue to rise, as the total number of college graduates increases. It is also likely that the emphasis on college training in selecting personnel for executive positions in industry will increase further. However, there will continue to be many opportunities for persons without college training to establish and manage their own small businesses.

Employment Trends

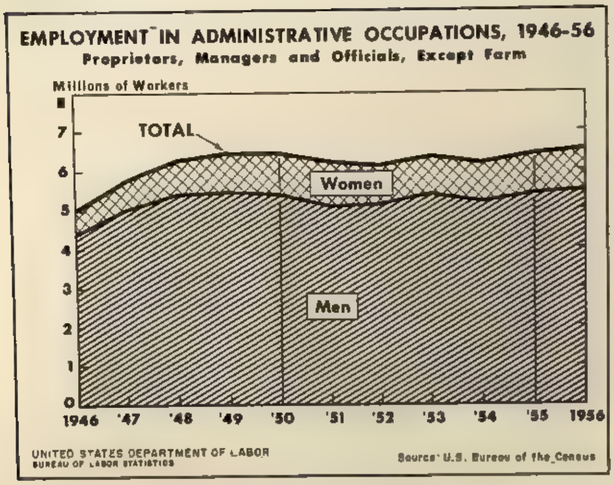
Administrative and managerial work is a growing field of employment in the United States. The proportion of workers employed as proprietors, managers, and officials showed a steady rise in each decade from 1910 to 1950, increasing from 6.5 percent to 8.7 percent of the total labor force during the 40-year period.

The numbers of proprietors and managers rose very sharply after the end of World War II, as many veterans opened their own businesses and companies filled administrative positions which had to be left vacant during the war, because of the manpower shortage. A peak was reached in 1949 (as shown in chart 24); for the next few years, the numbers of proprietors and managers either declined slightly or remained approximately the same. However, in 1955 and 1956, employment in this broad occupational group rose again; in the latter year, it exceeded 6.5 million, a new peak.

A marked expansion in business activity and total nonagricultural employment is expected in the United States over the long run. Some increase in the number of executive jobs will no doubt accompany this general increase in employment. However, the gains in employment of proprietors and managers as a group will probably be slow.

In salaried administrative positions, the main source of new job opportunities will be the need to

CHART 24.



replace executives who retire from business or die. In general, the top jobs will, of course, be filled by promotion of workers already employed in intermediate executive positions. However, these promotions will open opportunities farther down the ladder and will make room at the bottom for new graduates to enter as trainees. In view of the large proportion of executives in high-ranking administrative and technical jobs in industry who are in the upper-age brackets, a substantial percentage of these executives will have to be replaced during the next decade. Because of this situation, there are likely to be favorable opportunities for well qualified young men to enter administrative work in the late 1950's and early 1960's.

A number of managerial jobs are discussed in separate occupational reports in this Handbook. Among these jobs are those of hotel manager, restaurant manager, department store buyer, and bank officer. Accountants and personnel workers are examples of occupational groups, important in the management of many types of business enterprises, which have opportunities for advancement to high-level administrative jobs. Many members of other professions, such as engineers, chemists, and lawyers, also advance to administrative positions in industry and government. (See index for page references.)

TEACHING

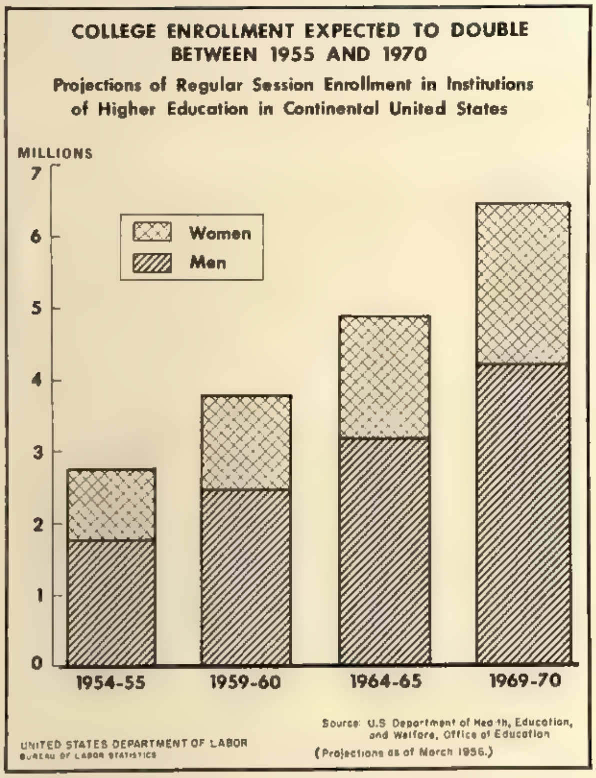
Teaching is the largest of all the professions. Approximately 1½ million men and women in the United States are full-time teachers, and thousands of others teach on a part-time basis. Many scientists, physicians, accountants, and members of other professions teach one or more classes in colleges and universities; similarly, large numbers of carpenters, mechanics, and other craftsmen teach part time in vocational schools.

No other profession offers so many employment opportunities to women as teaching; even the large field of nursing employs fewer than half the number of women engaged in teaching. For men, teaching is second only to engineering as a field of professional employment. Women teachers far outnumber men in kindergarten and elementary schools. However, the numbers of men and women are about equal in secondary (that is, junior and senior high) schools, and men hold about three-fourths of all college and university teaching positions.

The number of teachers needed by the Nation's schools depends chiefly, of course, on the number of pupils enrolled. Enrollment, in turn, depends to a large extent on the size of the school-age population. The high birthrates of the 1940 decade (chart 3) have, in the past 10 years, brought unprecedented increases in elementary school enrollments. By 1956, the increased numbers of children were beginning to enter the high schools, and before the end of the decade the colleges will be feeling the impact of the high birthrates. Enrollments above the elementary school level are expected to increase even more than the school- and college-age population, however, because of the persistent increase in the proportion of young people attending high school and college.

For many years, nearly all the children 6 through 13 years of age have been enrolled in school, but in the last 25 years there has been a spectacular rise in the proportion of youths of high school age (14 through 17 years) and college age (18 through 21 years) attending educational institutions. In 1930, only about half the group 14–17 years of age attended school; by 1955, more than 80 percent were enrolled. Similarly, the proportion of the college-age population in edu-

CHART 25



cational institutions increased from about 12 percent in 1930 to 33 percent in 1955. It is likely that these trends will continue, particularly at the college level.

On the basis of population trends and a conservative allowance for further growth in the proportion of high school graduates entering college, a remarkable rise is anticipated in college and university enrollment during the 15-year period ending 1970, as shown in chart 25. The sizable increases expected also in enrollments in elementary and secondary schools are shown, for the period 1955 to 1965, in chart 26.

In order to staff the new classrooms that must be provided for the rising numbers of students, tens of thousands of additional teachers will be needed annually. Moreover, still greater numbers will be required, particularly in elementary and high schools, to replace those who leave the profession. Although precise information is not available on the number leaving the field each year, it is conservatively estimated that at least

8 percent of the elementary and 5 percent of the high school teachers leave teaching annually. Using these replacement rates and assuming 1 teacher for each 30 new pupils in the lower grades and 1 for each 25 pupils in high schools, an estimate has been made of the annual demand for new teachers for elementary and secondary grades. The total number of new teachers needed yearly, through grade 12, is expected to range from about 150,000 in the late 1950's to more than 165,000 in the early 1960's. (See chart 27.) Estimates of the demand for teachers at each educational level—in elementary and in secondary schools, and also in colleges and universities—are discussed in the following statements on these three broad areas of teaching.

CHART 26

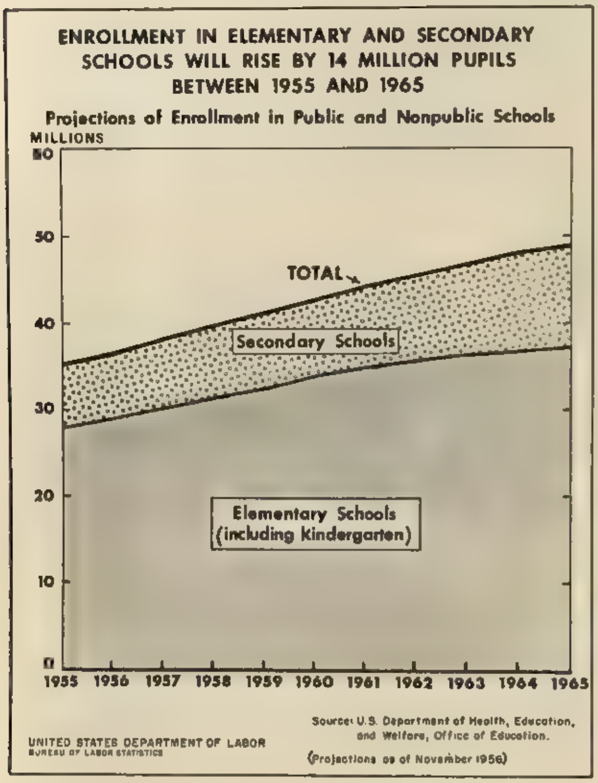
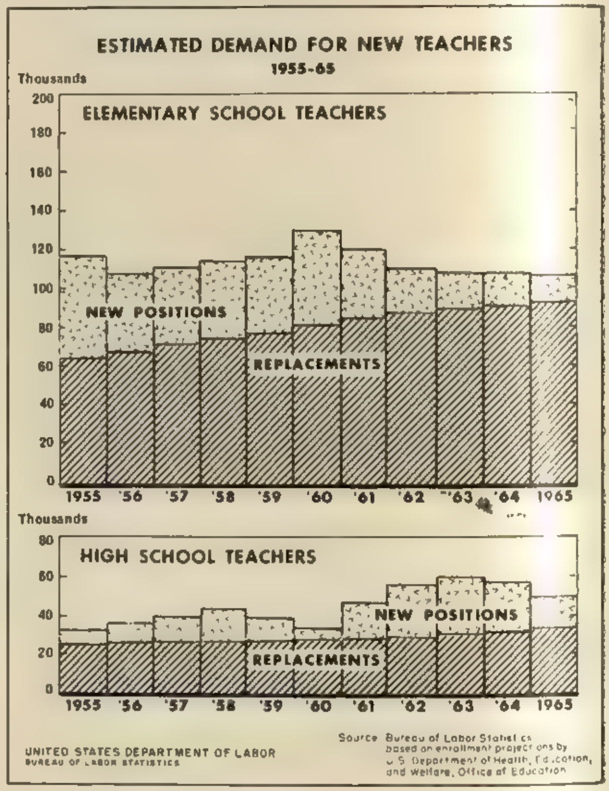


CHART 27



Kindergarten and Elementary School Teachers

(D. O. T. 0–30.02 and .11)

Nature of Work

Elementary school teaching is the largest field of professional employment for women and is also a growing field for men. In 1955–56, more than 700,000 classroom teachers (87 percent women) and several thousand principals and supervisors were employed in public elementary schools. In addition, more than 100,000 teachers were employed in parochial and other private schools.

Kindergarten and elementary school teachers usually work with one group of pupils during the entire school day, teaching a wide range of subjects and supervising various activities. However, in some school systems, teachers in the upper elementary grades may instruct several groups of pupils in 1 or 2 subjects. Many school systems also employ special teachers of art, music, and physical education. Teachers in schools with only a few students, especially in rural areas, may have to teach all subjects in more than one grade.

Although the time spent in the classroom is usually less than the average working day in many other occupations, the elementary school teacher must spend additional time each day on such activities as planning work, preparing instructional materials, developing tests, checking papers, making out reports, and keeping records.

Thousands of new teachers are needed each year in elementary schools.

Conferences with parents, meetings with school supervisors, and other professional activities also frequently occur after classroom hours.

Where Employed

Elementary school teachers are employed in all cities, towns, villages, and in many rural areas. About half the teachers in grades 1 through 8 and nearly all the kindergarten teachers are in towns and cities with more than 2,500 population. Although the number of 1-room schools is decreasing as a result of reorganization of school districts, about 40,000 teachers are still employed in these schools, which are located chiefly in the North Central States.

Training and Other Qualifications

All States require every teacher in the public schools to hold a certificate. The amount of education required for certification differs considerably from State to State, but there is a steady trend toward uniform educational standards. In 1956, 31 States and the District of Columbia issued regular teaching certificates only to persons with at least 4 years of approved college preparation, and 12 other States required at least 2 years. Only 5 States gave regular certificates for teaching in the public elementary schools to persons with 1 year or less of preparation.

Few States (in 1956, only Alabama, Iowa, Michigan, Nebraska, and South Dakota) require teachers in parochial and other private schools to hold certificates. However, most States refuse to accredit schools unless the teachers are properly certificated; therefore, administrators of all types of schools generally prefer to hire teachers meeting State certification requirements.

In nearly all States, certificates are issued by State departments of education on the basis of transcripts of credits and recommendations from approved colleges and universities. Certificates may be issued to teachers from other States if the necessary programs have been completed at accredited colleges.

Every State and many individual school systems have certain additional requirements for public school teaching. For example, 25 States require a health certificate, 29 require United States citizenship or at least filing of the first papers, and 30 require an oath of allegiance. The prospective teacher should find out about the exact requirements of the area in which he plans to work by writing to the State department of education or to the superintendents of local systems.

Most institutions of higher education offer teacher preparation; however, the majority of elementary school teachers attend teachers' colleges or liberal arts colleges. In a 4-year teacher-training curriculum, the prospective elementary school teacher spends roughly one-fourth of the time in learning about children, the place of the school in the community, and materials and methods of instruction—including practice teaching in an actual school situation; the balance of the time is devoted to studying cultural and related subjects common in the usual liberal arts program. Kindergarten and elementary school teachers seldom have a subject-matter major; most of them receive degrees in education.

Inexperienced teachers often start in rural schools or small town systems. Opportunities for advancement may come through annual salary increases in the same school system, shifting to another system with a higher salary schedule which recognizes experience gained in another school system, by appointment to a supervisory, administrative or specialized position, or by obtaining additional preparation.

Employment Outlook

The shortage of elementary school teachers which existed in 1956 is likely to continue into the 1960's. The number of students preparing for elementary school positions falls far short of the demand for new teachers. Fewer than 50,000 students qualified for such teaching positions in 1956,

whereas twice that number were needed. The deficit has been met by issuing short-term emergency certificates to teachers not meeting regular requirements and by increasing the size of classes. Shortages have tended to be most acute in areas where teachers' salaries are lowest or where there are many better paying employment opportunities in other fields. It has been especially difficult to fill positions in rural areas and small towns.

Enrollments in kindergarten and grades 1 through 8, which expanded from about 22 million in 1950 to 29 million in 1956 owing to the high birthrates following World War II, will continue to rise during the rest of the decade. The U. S. Office of Education points out that every 5 minutes, day and night, a new classroom of children reaches school age. It is estimated that more than a million students will be added to the elementary school rolls each year until 1960, and more than 35,000 new teachers will be needed annually to take care of the increase in enrollment.

Many more teachers will be required as replacements than for new jobs, even in this period of rapid growth of school population. Each year, a large number of young women enter the teaching profession and then withdraw because of marriage or for other reasons. In addition, many teachers will reach retirement age. The replacement rate varies among States, but is conservatively estimated at about 8 percent for the country as a whole. At this rate, more than 60,000 elementary school teachers will be needed annually to replace those who will leave in the late 1950's.

The demand for teachers to staff new kindergarten and elementary school classrooms is expected to level off in the 1960 decade. Nevertheless, more than 100,000 new teachers will be required annually through 1965, unless replacement rates are reduced considerably. This figure does not provide for additional teachers needed to bring about improvements such as lower pupil-teacher ratios in overcrowded classrooms, replacement of persons not meeting regular requirements, and extension of kindergarten facilities to all areas.

Barriers to the employment of certain groups, particularly married women and older men and women, are being continually reduced largely because of shortages of teachers. Members of these groups tend to find opportunities especially good in their own small communities, where lower salaries or isolated living conditions may not attract nonresidents.

Earnings and Working Conditions

Beginning salaries for kindergarten and elementary school teachers in 1955–56 were generally between $3,000 and $3,500. A survey representing 65,000 women who graduated from college in June 1955 showed that nearly 45 percent were engaged in teaching in elementary schools in 1956, at an average annual salary of $3,242; this compares with an average salary of $3,141 for all employed women included in the survey.

The estimated average salary for all classroom teachers in elementary schools (including those with various amounts of experience) was $3,800 in 1955–56—an increase of about $1,000 over the past 5 years. Teachers in 15 States had salaries averaging more than $4,000; in 12 States, salaries averaged between $2,000 and $3,000.

Teachers' salaries are usually lowest in rural schools and highest in large city systems, where educational and experience requirements are likely to be high. According to a survey by the National Education Association, median salaries for elementary school teachers and principals in public urban schools in 1954–55 were as follows:

Population of city	*Classroom teachers*		*Principals*	
	Kindergarten	*Elementary*	*Teaching*	*Supervising*
2,500–4,999	------	$3,465	$3,919	$4,773
5,000–9,999	------	[1] 3,591	3,996	5,175
10,000–29,999	------	[1] 3,857	4,357	5,479
30,000–99,999	$4,041	4,028	4,677	5,897
100,000–499,999	4,107	4,055	4,278	6,321
500,000 and over	4,850	5,110	[2] 7,475	7,956

[1] Includes kindergarten teachers.
[2] Assistant principals.

Most schools are in session about 9 months a year. Teachers, therefore, have a long vacation period, during which they often take summer courses to help them obtain advancement and salary increases.

Where To Go for More Information

Information on schools and requirements in a particular State is available from the State department of education at the State capital.

General information on teaching may be obtained from:

U. S. Department of Health, Education, and Welfare, Office of Education, Washington 25, D. C.

National Education Association.
1201 16th St. NW., Washington 6, D. C.

Secondary School Teachers

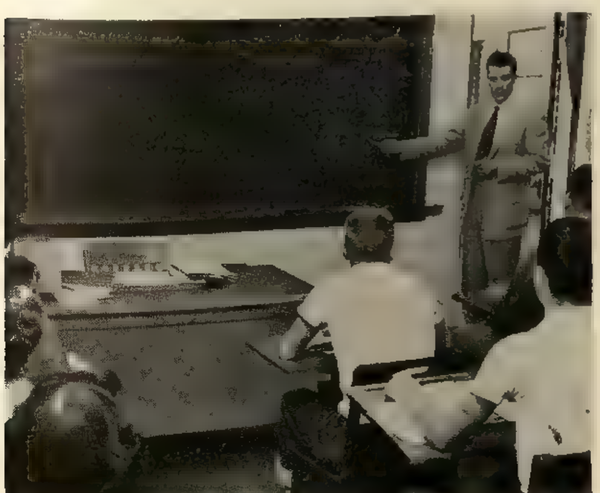
(D. O. T. 0–31.01 and .10)

Nature of Work

Secondary school teachers—those employed in junior and senior high schools—usually specialize in a subject-matter field such as English, history, mathematics, or science. They teach several classes every day either in their main field only or in that field and 1 or 2 related subjects. The most frequent combinations are English and history or other social-science subjects; mathematics and general science; and chemistry and biology or general science. Teachers in fields such as home economics, agriculture, commercial subjects, music, art, and industrial arts are less likely to have classes in other subjects.

Besides giving classroom instruction for from 20 to 30 hours each week, secondary school teachers also develop and plan teaching materials, develop and correct tests, keep records, make out reports, consult with parents, and perform other duties. Many of them supervise students' extra-class activities—sometimes after regular school hours. Maintenance of good relations with parents, the community, and fellow teachers is an important aspect of their jobs.

Approximately 500,000 teachers, principals, and supervisors were employed in the Nation's public and private secondary schools in 1955–56, to teach about 8 million pupils. Nearly half the classroom teachers in public secondary schools were men; the proportion of women was somewhat higher in private schools. Men outnumber women in supervisory and administrative positions in both public and private schools.



Teachers of mathematics are in great demand.

Where Employed

Secondary school teachers are employed in 4-year high schools (grades 9–12), 3-year junior high schools (grades 7–9), 3-year senior high schools (grades 10–12), and 6-year combined junior-senior high schools (grades 7–12). About 40 percent of the public secondary schools, which enroll about 25 percent of the pupils, are of the 4-year type; the majority of these are located in towns with a population of less than 2,500. Most of the separately organized junior high schools are in large cities.

Although nearly half of all secondary school teachers teach in cities of 10,000 or more population, about one-third are employed in communities with less than 2,500 population.

Training and Other Qualifications

A certificate is required by each State for secondary school teaching. The usual educational requirement for a certificate is a bachelor's degree, with the equivalent of at least one-half year of education courses, including student teaching, and specialization in one or more subjects commonly taught in secondary schools. A few States will grant secondary certificates only to people with a year of graduate work. Many school systems, especially in large cities, have requirements beyond those needed for State certification. Some systems require additional educational preparation, successful teaching experience, or special personal qualifications.

College students preparing for secondary school teaching usually devote from one-fourth to one-third of the 4-year course to their major, which may be a single subject or a group of related subjects. About one-fifth of the time is spent in education courses—learning about children, community life, and materials and methods of instruction. The remaining time is devoted to general or liberal education. Satisfactory teacher-training curriculums are offered by universities with schools of education (which prepare about 40 percent of all high school teachers), by colleges with strong

education departments and adequate practice teaching facilities, and by teachers' colleges.

Although certification requirements vary among the States, the person who is well prepared for secondary school teaching in one State usually has little trouble meeting requirements in another State. A well-qualified teacher can ordinarily obtain temporary certification in a State while he prepares to meet any unusual requirements.

Qualified secondary school teachers may advance to positions as supervisors, assistant principals, principals, superintendents, or other administrative officers. At least 1 year of professional education beyond the first college degree and several years of successful classroom teaching experience are usually required for most supervisory and administrative positions. A few experienced teachers are assigned to positions as part- or full-time guidance counselors, visiting teachers, or instructors of handicapped or other special groups.

Employment Outlook

The shortage of secondary school teachers in certain subject fields, which existed in 1956, is likely to persist throughout the rest of the 1950's. As enrollments continue to increase during the 1960 decade, employment opportunities for secondary school teachers will expand greatly.

In 1956, demand exceeded the supply of qualified personnel available for teaching mathematics, science, and home economics, in nearly all parts of the country. Many schools were also having difficulty hiring teachers of girls' health and physical education, music, agriculture, industrial arts, and commercial subjects. In some other subject fields, the supply of teachers was greater than the demand in a few localities. In general, those areas where industries employed many persons having college training in the sciences and where school system salaries were low, were having the most difficulty recruiting teachers.

The demand for high school teachers will continue to rise during the late 1950's. Enrollments in grades 9 to 12, which increased by about a million during the first half of the 1950 decade, are expected to expand by nearly 2 million over the last half of the decade. The number of new teachers needed each year to 1960 to take care of newly formed classes will average more than 15,000. In addition, at least double that number will be required to replace teachers who retire or otherwise leave the teaching profession.

The supply of persons available to fill teaching positions each year is difficult to estimate. In 1955, approximately 50,000 college graduates met certification requirements for secondary school teaching. However, by the fall of that year, more than a third of the graduates were employed in positions other than teaching, were in the military service, had become homemakers, or were otherwise lost to the teaching field. Similarly, a large proportion of the 57,000 potential teachers graduated in 1956 were not available for teaching positions. If this situation persists throughout the rest of the decade, well-qualified candidates seeking to enter secondary school teaching will find employment opportunities in most areas.

A growing number of teachers will be needed during the 1960's, when enrollments will expand rapidly as a result of the high birthrates following World War II. The great increase in population reaching high school age, combined with the trend for a growing proportion of young people to enter and graduate from high school, will result in a demand for more than 20,000 teachers each year, on the average, to handle new classes during the early 1960's. The number of teachers needed in the last half of the decade will be only slightly lower. Throughout the 10-year period, vacancies created by turnover will exceed the number of new positions. Employment opportunities for teachers are expected to continue to be best in science, mathematics, and other subject fields where the demand in private industry is also great, unless there is a considerable decline in economic activity with resulting unemployment. Under conditions of economic decline, teaching will, as has been demonstrated historically, become a highly competitive field and certification requirements will probably be raised.

Earnings and Working Conditions

Classroom teachers in secondary schools had an average annual salary of about $4,350 in 1955–56. In a few, predominantly rural, southern States, their average salary was less than $3,000. In New York, California, and New Jersey, it was more than $5,000.

Junior high school teachers frequently receive

somewhat lower salaries than high school teachers in the same school system; however, the trend is toward equalizing salaries of teachers with the same educational preparation regardless of grade taught. Teachers of vocational education, physical education, and other special subjects often receive higher salaries for their work than do other teachers in the same school.

Under the salary schedules in effect in most school systems, teachers receive regular salary increases as they gain experience and additional education.

Salaries of teachers are usually lower in towns and small cities than in larger cities, but educational and experience requirements in large city school systems are likely to be higher. On the average, salaries of principals in the largest cities, where administrative responsibilities are great, are much higher than in towns and small cities. According to a survey by the National Education Association, median salaries for classroom teachers and principals in public urban secondary schools in 1954–55 were as follows:

	Classroom teachers		*Principals*	
Population of city	*Junior high*	*High school*	*Junior high*	*High school*
2,500–4,999	$3,579	$3,848	$4,650	$5,171
5,000–9,999	3,751	4,021	5,262	5,607
10,000–29,999	4,103	4,385	5,824	6,366
30,000–99,999	4,382	4,686	6,500	7,225
100,000–499,999	4,311	4,650	6,870	7,373
500,000 and over	4,931	5,864	8,600	9,692

Where To Go for More Information

Information on schools and requirements in a particular State is available from the State department of education at the State capital.

General information on teaching may be obtained from:

U. S. Department of Health, Education, and Welfare,
Office of Education, Washington 25, D. C.

National Education Association,
1201 16th St. NW., Washington 6, D. C.

College and University Teachers

(D. O. T. 0–11.50)

Nature of Work

More than 160,000 teachers were employed full time in the Nation's 1,855 colleges and universities in 1956. In addition, thousands of teachers were employed part time, especially in such fields as medicine, law, and business administration. Men predominated in most college teaching fields and held about 95 percent of the positions in engineering, the physical sciences, agriculture, law, and philosophy. About one-fourth of all full-time teachers were women; only in nursing, home economics, and library science were they in the majority.

The chief function of college and university teachers is instructing students in a specific subject field. More than half teach courses in social science, fine arts, English, physical science, education, or engineering. In addition to teaching classes from 6 to 15 hours a week during the academic year, the college teacher spends a considerable amount of time preparing tests and other materials for classroom use, checking and grading student work, enlarging his own understanding of his subject, keeping up to date with developments in his field, taking part in academic administration, writing for publication, and lecturing to civic and professional groups. Faculty members also frequently engage in research; some act as consultants to business, industrial, scientific, or government organizations; a substantial number become full-time administrators.

Where Employed

More than half of all faculty members are employed by universities; about 20 percent by liberal arts colleges; from 5 to 10 percent each by teachers' colleges, by community (junior) colleges, and by technical schools; and fewer than 5 percent by theological and other professional schools.

The distribution of colleges and universities among the States is extremely uneven, primarily because of differences in population. Some western States have but 1 or 2 colleges with only a few hundred faculty members altogether. On the other hand, a few States with the largest populations each have more than 100 institutions and more than 10,000 faculty members. About half of all college and university teachers are employed in the following eight States, each having college enrollments, which exceeded 100,000 in 1956: New York, California, Pennsylvania, Illinois, Massachusetts, Texas, Ohio, and Michigan.

Training and Other Qualifications

Graduate training, often including completion of all preliminary work for the doctorate except the dissertation, is a common requirement for college teaching. The doctor's degree is frequently, but not uniformly, required for promotion or appointment beyond the rank of instructor. However, outstanding students often assist in teaching undergraduates while still taking graduate work. At some institutions, possession of a master's degree qualifies the holder for an instructorship, at least when further graduate study is contemplated.

The doctor's degree is required for the better teaching positions, but requirements vary considerably by type of appointment and institution and by subject field. A survey of more than 600 degree-granting institutions in 1953–54 showed that 84 percent required the doctorate for appointment to a full professorship, 44 percent, for appointment to an associate professorship, 15 percent, for an assistant professorship, and 3 percent, even for an instructorship. The doctorate is most likely to be required for teaching psychology, biological sciences, physical sciences, social sciences, and philosophy; it is least likely to be a requirement in fields such as health and physical education, fine arts, engineering, business and commerce, and home economics.

Advancement depends to a considerable extent on length of experience and educational attainment of the teacher. Few institutions grant tenure (full status as a member of the staff on a continuing basis) or give advancement to instructors with less than 3 years of service. Assistant and associate professorships are attained only after considerable graduate training or experience. To advance to the rank of full professor usually requires a number of years of successful college teaching experience, as well as the Ph. D. degree. Outstanding achievement, generally through research or publications, often hastens advancement.

Employment Outlook

Openings for new entrants to college teaching will be numerous in the late 1950's and will increase greatly during the 1960's. Opportunities will be best for those with doctoral degrees and those who have completed all requirements for the doctorate except the dissertation.

The demand for teachers is, of course, closely related to the number of students attending college. In 1955–56, enrollment in institutions of higher education was about 3 million. This was the highest enrollment ever recorded, despite the fact that the college-age population (18 to 21 years) was lower than at any time during the 1930's and 1940's. The proportion of young people attending college more than doubled during these two decades and, by 1956, had risen to about one-third of the 18 to 21 age group.

A great increase in the population 18 to 21 years of age is in prospect. The number of young people in that age group will rise by about 1 million between 1955 and 1960, by 2½ million in the following 5-year period, and by 2½ million between 1965 and 1970. At the same time, it is likely that the extension of college education to a higher proportion of young people will continue—owing to such factors as rising family income, greater demand for college-trained personnel, the increasing number and proportion of the population who finish high school and are, therefore, eligible to enroll in college, and the accessibility of college education to more of the population (through community colleges and evening sessions and through the greater availability of scholarships and other financial aids). Assuming a moderate increase in the proportion of the age group attending college (less than 1-percent increase each year) and assuming that training facilities will be available, the number of students in 1970 will be double the 1955 enrollment. To handle this increase in enrollments, an average of about 10,000 additional teachers will be needed annually to 1960, about 15,000 annually in the early 1960's, and more than 20,000 each year during the late 1960's.

Besides the new teachers needed to take care of expanding enrollments, about 10,000 may be required annually in the late 1950's to replace persons who retire or otherwise leave the profession. The death and retirement rate will probably continue high for many years since, in 1955, approximately 8 percent of all full-time college teachers were more than 60 years old and another 10 percent were between 55 and 60. In addition, some will leave teaching each year to enter other types of employment; the number leaving will depend primarily on the level of business activity and on conditions in the academic profession itself.

The supply of new college teachers comes largely from students receiving graduate degrees. The U. S. Office of Education estimates that the number of doctorates conferred in the last half of the 1950 decade will average about 8,800 a year and will rise gradually during the early 1960's to approximately 15,000 in 1965. Similarly, the number of master's degrees will average close to 70,000 annually in the late 1950's and may rise to more than 100,000 in 1965. It is impossible, however, to predict the proportion of graduates who will enter teaching. In 1955, when the demand was probably for fewer than 20,000 new teachers, more than 65,000 persons received graduate degrees; nevertheless, shortages of teaching personnel were reported in several fields, particularly in the physical sciences, engineering, and mathematics. In all likelihood, the supply of well-qualified persons available for teaching positions will continue to be insufficient to meet the demand in many subject fields throughout the 1960's. (See index for page numbers of separate statements on each profession.)

Earnings and Working Conditions

Salaries of instructors averaged about $4,000 in 1956. In most institutions, the average salary of assistant professors was at least $1,000 more than that of instructors. Salaries of associate professors averaged between $5,500 and $6,500 in the better paying small colleges and between $7,000 and $8,000 in large institutions. Salaries of professors generally averaged between $8,000 and $11,000 in the most adequately financed institutions.

Salaries of teachers tend to be lowest in community colleges, small liberal arts colleges, and women's colleges; they are highest in State universities, technological institutes, and large privately controlled universities. Average salaries in 1955–56 for teaching personnel in selected privately controlled institutions in New England and the Middle Atlantic States were as follows:

3 women's colleges	$5, 630
6 small institutions	6, 370
5 medium-size institutions	6, 780
5 large institutions	7, 170

Average salaries of teachers in a group of well-financed institutions increased by about a third from 1948 to 1956. Further increases seem likely, partly as a result of large contributions by private foundations and business corporations.

Many faculty members have some professional income in addition to their regular salaries. The chief source of supplementary income is other teaching (often in summer sessions) not a part of the teacher's regular duties. Consulting work is a major source of extra income, particularly for teachers of engineering and physical sciences. A few teachers have considerable income from lecturing and from royalties on publications. Those who have achieved professional recognition are the most likely to be offered opportunities to supplement their regular salaries.

Retirement plans differ considerably by institution, but an increasing number of colleges and universities are participating in the Government social security program, often as an accompaniment to plans of their own. The greatest number of institutions have set 65 years as the retirement age, though nearly as many stipulate 70 years. In any case, most institutions permit exceptions to the age limit.

Where To Go for More Information

U. S. Department of Health, Education, and Welfare,
Office of Education, Washington 25, D. C.

American Association of University Professors,
1785 Massachusetts Ave. NW., Washington 6, D. C.

National Education Association,
1201 16th St. NW., Washington 6, D. C.

Professional societies in the various subject fields will generally provide information on teaching requirements and employment opportunities in their particular professional fields. For names and addresses of societies, see statements on specific professions.

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HEALTH SERVICE OCCUPATIONS

Medical and other health service occupations not only are vital to the welfare of the country but also are a major source of employment for both men and women. In 1950, more than 1¼ million persons were employed in the health field, and since then the number has undoubtedly increased.

Foremost among the health occupations are the professions of nurse, physician, pharmacist, and dentist, in which large numbers are employed. Included also are a number of smaller professions and several small groups of technicians and other specially trained workers, such as dental hygienists and X-ray technicians. In addition, many workers are employed as hospital attendants and practical nurses, occupations in which a lesser amount of training is generally required.

Workers in the health field are employed in a wide variety of places including hospitals, sanitariums, clinics, laboratories, pharmacies, nursing homes, industrial plants, offices of private practitioners, and patients' homes. Although employment tends to be concentrated in the heavily populated and wealthy sections of the country and in big cities, some health workers are found in every village and town.

More than three-quarters of a million women workers were employed in the health occupations in 1950. Of these, well over half a million were engaged in professional and technical work. Nursing, the largest of the major health service occupations, is second only to teaching as a source of professional employment for women. Other health related occupations in which women predominate are practical nurse and hospital attendant, medical X-ray technician, laboratory technician, dietitian, dental hygienist, physical therapist, occupational therapist, and medical record librarian.

About half a million men were in the health field, chiefly in professional occupations. Medicine ranks with engineering, accounting, teaching, and law as a major profession for men. The health professions in which men predominate offer many opportunities for independent practice. For example, in 1950, almost 90 percent of all dentists and 65 percent of all physicians were self-employed.

Employment in the health fields has been increasing and is expected to continue to grow. The country's expanding population and the rising health consciousness of the general public will be reflected in a growing demand for medical, dental, nursing, and other health services. In addition, such factors as the extension of hospitalization and other medical insurance plans, the rapid expansion of expenditures for medical research, and continued provision of health care for veterans and members of the Armed Forces point toward the need for additional health personnel. Moreover, many new workers will be needed each year to replace those who die, retire, or—particularly in the case of women—leave the field for other reasons. Thus, there will be many opportunities for employment in the health occupations over the next decade.

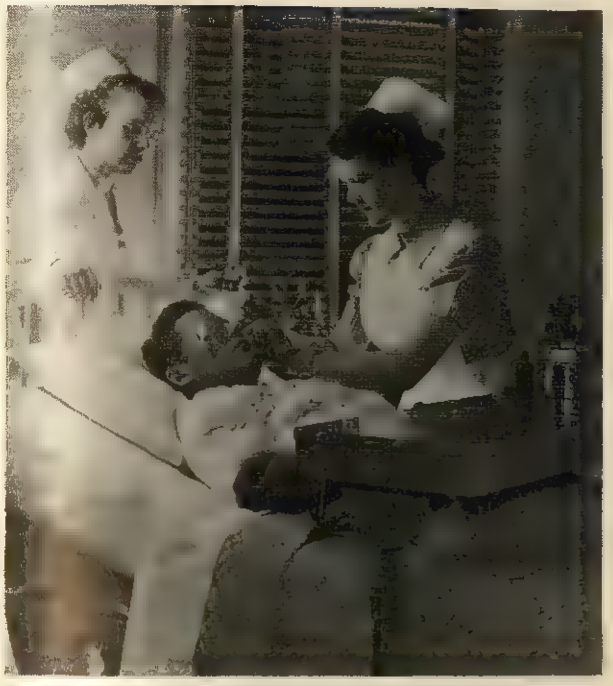
Registered Professional Nurses*

(D. O. T. 0-33)

Nature of Work

Registered professional nurses play an important role in our Nation's medical and health services. They have the primary responsibility for carrying out physicians' instructions and supplementing their services by performing independent nursing functions. Most members of the profession are general duty nurses, primarily concerned with the care and welfare of patients. The tasks performed by such nurses include administering medicines, ointments, and drugs; observing and reporting temperature, pulse, and respiration; and evaluating symptoms and reactions. Nurses also perform such therapeutic tasks as changing dressings; bathing, massaging, and feeding patients; and assisting in the education

*Prepared by the Women's Bureau of the U. S. Department of Labor.



The student nurse trains under the constant supervision of a professional nurse.

of patients regarding their condition and rehabilitation. A nurse who performs these duties may be employed as a general staff nurse in a hospital, health institution, or health agency; or as a private duty nurse working for an individual patient. Regardless of the employer, the nurse works under the direction of the attending physician.

Professional nurses may also specialize in some aspects of patient care and treatment. A nurse specializing in obstetrics, for example, may assist the physician in the delivery room; an instrument nurse may work exclusively in the operating room, handling complex technical equipment in connection with surgery; a nurse in a health agency may provide patient care in a specific area of medical specialization, such as heart disease, cancer, or infantile paralysis.

A growing field of specialization for nurses, which includes duties outside of direct patient care, is in public health education and improvement. Here the emphasis is on prevention of disease and promotion of health and rehabilitation in the community. As an employee of a public or private agency concerned with health programs, the nurse may perform such diverse functions as demonstrating diet plans to groups of patients, helping to prepare charts and booklets on home health and sanitation, or providing information about disease prevention to families of migrant workers.

Nurses in industrial establishments are concerned with the health needs of employees. They may work in health service departments which provide employees with emergency care, health examinations, and health counseling. These nurses may also assist in developing programs for the prevention and control of accidents and occupational diseases, and in maintaining sanitation and safety standards in the plant. Nurses in doctors' and dentists' offices work in a team relationship with the physician, caring for patients and performing laboratory and other services for the physician.

Nurses who have college degrees in nursing education or nursing administration may specialize in these areas. Typical duties include teaching such courses as nursing techniques or nursing ethics, serving as executive secretaries on State boards of nurse examiners, or directing the activities of nursing personnel in hospitals.

Where Employed

In 1956, the number of employed professional nurses was about 430,000, according to estimates of organizations in the field of nursing. About 65 percent of the nurses worked for hospitals, schools of nursing, and other institutions; 17 percent for private individuals, 8 percent for physicians and dentists in private practice; and the remainder for public health agencies (6 percent) or industrial establishments (4 percent). All branches of the military service employ commissioned nurse officers, and there are some jobs overseas with public or private social, religious, and welfare agencies or with the Federal Government. This occupation is second only to teaching in the employment of professional women. Only 2 percent of all nurses are men. Since the vast majority of communities maintain some health facilities and services, nurses may be employed almost anywhere in the country, provided they can meet the State licensing requirements.

Training and Other Qualifications

Two types of schools, hospital-controlled and college-controlled schools, offer the preparation required for professional nursing. Hospital schools offer 3 years of training, leading to a diploma in

nursing. Collegiate schools offer from 4 to 5 years of training leading to a bachelor's degree; some offer a program (open only to college graduates) leading to a master's degree. Of the 1,125 State-approved schools of nursing in the United States in 1956, 83 percent were hospital schools which had an enrollment of 93,530 diploma students, or 85 percent of all student nurses. The 194 collegiate schools had 16,374 students. Newer associate degree programs in the junior and community colleges, usually 2 years in length, currently enroll approximately 1,000 students.

A high school diploma, usually from a college preparatory course, is a minimum requirement for admission to either a hospital or collegiate school. Demonstrated competence in science and mathematics may also be required. Some schools accept only those students who have graduated in the upper third or half of their class. A few schools accept only students who have completed 2 years of college work. The usual age limits for admission are a minimum of 18 and a maximum of 35 years.

Tuition and other expenses of an education in nursing vary widely among schools of nursing. In most schools, some of the cost of the training is compensated for by services which the student nurse performs for the hospital. Training in hospital schools is usually less expensive than in collegiate schools because the latter include a full college curriculum. Scholarships and loans for training in nursing are available from nursing schools, and various civic and professional organizations, women's clubs, and business groups. The Public Health Service, the Children's Bureau, and the Office of Vocational Rehabilitation of the U. S. Department of Health, Education, and Welfare also make some training stipends available for graduate nurse education or for a specific field of nursing.

Professional nurses must be licensed to practice nursing within a particular State. To obtain a license, the nurse must have graduated from a school approved by the State board of examiners and must pass a State board examination. All State boards use a uniform examination prepared by the National League for Nursing, but each State establishes its own passing grade. A nurse may be registered in more than one State either by examination or by endorsement of a license issued by another State. Examination and endorsement fees range from $5 to $30, depending on the State.

Hospital nursing usually begins with general duty work from which nurses may advance to progressively more responsible supervisory positions such as head nurse, supervisor, assistant director, and director of nursing services. Advancement is possible for both diploma nurses and degree nurses; but degree nurses who are specifically trained in nursing administration usually progress much more rapidly to the higher administrative and executive positions. Advancement may also come with the acquisition of a clinical specialization in nursing.

A degree in nursing is usually required for entry into the fields of public health nursing and nursing education. Advancement in these fields is to progressively more responsible program planning and consultant work.

Employment Outlook

A shortage of professional nurses, which has existed since the 1940's, was still very much in evidence in 1956, when it was estimated that 70,000 additional nurses were needed. In consequence, practically no age limitations were being placed upon qualified professional nurses seeking to reenter the labor market. Furthermore, a number of hospitals, which were faced with serious shortages of nurses, established child-care centers, organized special transportation facilities, and created part-time jobs to facilitate the reemployment of inactive nurses.

The shortage of nurses was not due to a drop in the number of active nurses, which has greatly increased in proportion to the population from 55 nurses per 100,000 population in 1910 to 259 in 1956, but rather to a rising demand. Factors which have helped to create this increasing demand include: The expansion of medical services brought about by discoveries of new medical techniques and drugs; the improved economic status of the population; the increasing participation of people in hospitalization and health plans; the growth of preventive medical services; and the changing composition of our growing population with its increasing proportions of very young and older persons who frequently require greater than average medical care.

The demand for nurses is expected to continue to be strong for the remainder of the 1950's and

during the early 1960's. In addition to the nurses who will be needed annually to fill new positions, many will be needed to replace those who leave the field. Leaders in the nursing field have estimated that about 5 percent of all professional nurses leave active nursing each year. Furthermore, since 1948 only about two-thirds of the nursing students enrolled each year have remained to graduate. In 1955, it was estimated that nursing schools must admit 58,000 students annually to meet immediate needs and the needs of the next few years. This figure exceeds by some 15,000 the annual student nurse enrollment in each year since 1948. Some of this demand will be met by reentry—at least on a part-time basis—of inactive nurses, estimated in 1951 to be approximately 40 percent of the total of all registered nurses. (About two-thirds of these inactive nurses were under 40 years of age in 1951.)

Demand for nurses with advanced preparation in such specialties as psychiatric nursing, nursing education, supervision and administration, and public health work, is expected to rise even faster than for less highly trained personnel through the early 1960's. Factors underlying this demand are the increasing complexity of nursing functions associated with new discoveries in medical knowledge and techniques; the anticipated extension of high quality nursing care to more people; and the growing emphasis on preventive medicine through improved and extended health education of the population. College-trained personnel will undoubtedly continue to have excellent opportunities in these specialties during this period.

Over the long run, the nursing profession is expected to expand because of the continuing effect of those factors which have produced the present demand, but also because of the anticipated population growth. However, the nature of the expansion in the profession is not clear. Some modifications have already been made in the functions of professional nurses, and further studies are being directed toward the most effective utilization of nurses and the best patterns of training for the occupation. A number of junior colleges and some hospitals are experimenting with a 2-year program of training bedside nurses. Graduates of these programs are eligible for the State board examination in nursing. However, the growing demand for highly trained degree nurses for administrative, supervisory, and teaching jobs is expected to continue.

Earnings and Working Conditions

Average salaries of nurses employed in hospitals in 16 metropolitan areas in 1956–57 ranged from $58.50 to $75.50 a week for general duty nurses and from $100.50 to $124.50 for directors of nursing. General duty nurses earned somewhat less than medical record librarians, physical therapists, and dietitians whose salaries were closer to those of head nurses. The following tabulation from a Bureau of Labor Statistics survey shows average straight-time weekly salaries for general duty nurses in these areas:

Atlanta	$59.50
Baltimore	66.00
Boston	64.50
Buffalo	66.00
Chicago	73.00
Cincinnati	68.00
Cleveland	70.00
Dallas	68.50
Los Angeles–Long Beach	75.00
Memphis	60.00
Minneapolis–St. Paul	71.50
New York	69.50
Philadelphia	58.50
Portland (Oreg.)	70.50
San Francisco–Oakland	75.50
St. Louis	66.00

Professional nurses employed by industrial or business establishments averaged from $61.50 to $84.00 per week in 18 metropolitan areas during late 1955 and early 1956. Some of the highest salaries in the nursing field are paid to commissioned nurses in the Public Health Service, where annual earnings ranged from $4,063 to $11,745 in 1955. Private duty nurses earned from $12 to $14 for a basic 8-hour day in most States in 1955.

Although information on starting salaries for all nurses is not available, starting salaries of professional nurses with college degrees compare favorably with those of women in other professional occupations, according to a survey of June 1955 women college graduates conducted by the National Vocational Guidance Association and the Women's Bureau of the U. S. Department of Labor. Professional nurses averaged $3,438 annually, according to this survey; and these earnings were exceeded only by those of mathematicians and statisticians, who averaged $3,848, and of chemists, who averaged $3,900, annually.

The 1956–57 survey of hospital nurses in 14 metropolitan areas indicated that a majority of nurses worked a weekly schedule of 40 hours and

received equal time off or straight-time pay for overtime work. Almost all nurses received extra pay for evening or night shifts. Almost all nurses received at least 2 weeks of paid vacation after a year of service.

Where To Go for More Information

Further information on opportunities in professional nursing is available in the following publication:

The Outlook for Women in Professional Nursing Occupations. Women's Bureau Bull. 203-3, Revised, 1953. Superintendent of Documents, Washington 25, D. C. Price 30 cents.

Information on career opportunities, schools, and preparation for the profession may be obtained from:

Committee on Careers, National League for Nursing, 2 Park Ave., New York 16, N. Y.

Information on salaries, working conditions, and employment opportunities may be obtained from:

American Nurses' Association,
2 Park Ave., New York 16, N. Y.

Physicians

(D. O. T. 0–26.10)

Nature of Work

Physicians diagnose diseases and treat people who are ill or in poor health. In addition, they are concerned with the prevention of disease and the rehabilitation of the injured or ill. They generally examine and treat patients in their own offices and in hospitals, but also visit patients at home when necessary. Some physicians combine the practice of medicine with research or college teaching. Others hold full-time research or teaching positions, or perform administrative work in hospitals, professional associations, and other organizations. A few are primarily engaged in writing and editing medical books and magazines.

About half the physicians engaged in private practice are general practitioners—often referred to as "family doctors"; the others specialize in the treatment of particular types of ailments. In recent years, there has been a marked trend toward specialization; 32 specialties are recognized by the medical profession. Among the largest fields of specialization are surgery, internal medicine, pediatrics (medical care of children), obstetrics (childbirth), gynecology (women's diseases), psychiatry (diseases and disorders of the mind), radiology (use of X-ray, radium, and other radioactive sources), ophthalmology (the eye and its diseases), and otolaryngology (diseases of the ear, nose, and throat).

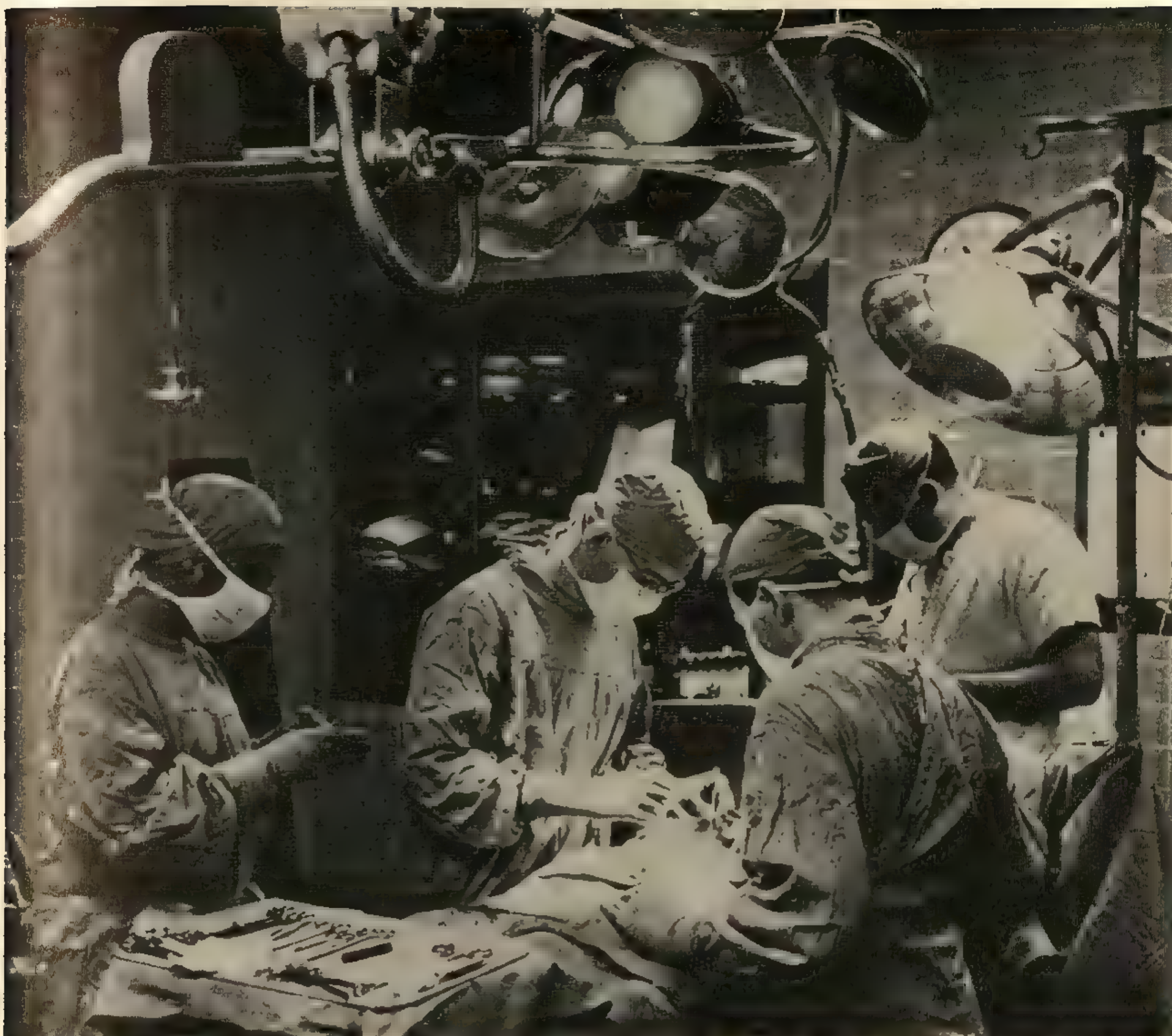
Where Employed

About 210,000 physicians were professionally active in the United States in 1955. The great majority—about 150,000—were engaged in private practice. Approximately 25,000 were interns or residents in hospitals, and another 15,000 held regular positions on hospital staffs. About 10,000 physicians were serving as commissioned officers in the Armed Forces, and more than 5,000 were employed in Federal Government agencies, chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service. The remainder were employed in private industry, State and local health departments, medical schools, research foundations, and professional organizations.

In 1956, more than 40 percent of all physicians were in the 5 States with the largest population: New York, California, Pennsylvania, Illinois, and Ohio. At the other extreme were 20 States which altogether had fewer than 10 percent of the profession. The Middle Atlantic States and New England had the highest ratio of physicians to population; the South had the lowest. As a rule, general practitioners are much more evenly distributed geographically than specialists, though both are concentrated in big cities and in certain regions of the country.

Training and Other Requirements

A license to practice medicine is required in all States and the District of Columbia. To qualify for a license, a candidate must graduate from an approved medical school, pass a licensing examination, and—in half the States—serve a 1-year hospital internship. (Although 24 States still permit a physician to be licensed immediately upon grad-



PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Surgeon and assistants form a team in performing an operation.

uation from medical school, it is universally recognized that an internship is necessary for acceptance by the profession, regardless of specific State requirements.) Nineteen States and the District of Columbia specify that applicants for medical licenses must first pass an examination in the basic sciences to become eligible for the medical licensing examination.

Licensing examinations are given by State boards. The National Board of Medical Examiners also gives an examination which is accepted as a substitute for State examinations by most States. Although physicians licensed in one State can usually obtain a license to practice in another without further examination, some States limit this reciprocity.

At least 8 years of training beyond high school is needed to become a physician—3 years of premedical college study, 4 years of professional education in a medical school, and 1 year as a hospital intern. Some medical schools require applicants to have completed 4 years of college education. Premedical study must be in an approved college and must include courses in English, physics, biology, and inorganic and organic chemistry. In addition, students are encouraged to acquire a broad general education by taking courses in the humanities and the social sciences.

In 1956, there were 76 approved medical schools in the United States which awarded the degree of doctor of medicine (M. D.) to students completing the 4-year course of study. In addition, 6 approved schools offered 2-year courses in the basic sciences; students completing these courses could then transfer to a regular medical school for the last 2 years of study. The first 2 years of medical training are devoted to laboratory and classroom work in basic medical sciences such as anatomy, biochemistry, physiology, pharmacology, microanatomy, and pathology. During the last 2 years, the student spends most of his time working in hospitals and clinics under the supervision of an experienced physician and learns to take case histories, perform examinations, and recognize diseases. Following completion of the 4-year medical course, all students serve at least a 1-year internship in a hospital.

To an increasing extent, young physicians are taking further training beyond the 1-year internship. Those who plan to enter general practice often serve an additional year as interns or residents in a hospital. A physician desiring to become a specialist must spend from 2 to 4 years—depending on the specialty—in advanced hospital training as a resident followed by 2 or more years of practice in the specialty in order to qualify for specialty board examinations. Doctors interested in teaching and research may take graduate work leading to the master's or Ph. D. degree in fields such as biochemistry and microbiology.

Every year, more young people apply to medical schools than can be admitted. Despite the expansion of training facilities, twice as many students applied for admission in 1955 as could be accepted. However, the number of applicants has decreased from the high point reached immediately after World War II when there were more than three applicants for each medical school opening.

In selecting students, each medical school establishes its own standards. As a rule, considerable importance is attached to a good scholastic record, the amount of premedical education (three-fourths of the freshman medical class in 1955 had completed 4 years of college), the premedical college attended, and the score earned on the Medical College Admission Test which is taken by almost all applicants. Consideration is also given to character, personality, leadership qualities, and other factors as evidenced in personal interviews and by extracurricular activities in college. Place of residence is important since many State-supported medical schools give preference to residents of the States in which the schools are located.

The majority of newly qualified physicians open their own offices. New graduates entering the Armed Forces are usually commissioned as first lieutenants or lieutenants (j. g.) and, if they make military service a career, can rise to the rank of colonel or the equivalent, and even higher. Graduates of approved medical schools are eligible for Federal Civil Service positions and for commissions in the U. S. Public Health Service.

Employment Outlook

Opportunities for physicians were excellent in 1956. Additional general practitioners were needed in many parts of the country, particularly in rural areas. Physicians were being sought for the growing fields of public health, rehabilitation, industrial medicine, and mental health. The continuing high birthrate was creating great demand for obstetricians and pediatricians. Medical schools reported unfilled faculty positions; there was a shortage of qualified physicians for medical research; and Federal, State, and local agencies found it difficult to recruit doctors for salaried positions. Many vacancies existed on hospital staffs and, despite the employment of 6,000 foreign interns and residents, there were more than 7,000 unfilled internships and residencies. The Armed Forces absorbed many new graduates as replacements for doctors completing military service.

During the late 1950's and early 1960's, the supply of new physicians is expected to increase steadily. Many medical schools are planning to expand, several new schools will be in operation, and three of the six 2-year basic science schools will become 4-year medical schools. As a result, the number of graduates is expected to rise from about 6,850 in 1955 to more than 7,300 by 1960 and to a greater number by 1965. Moreover, graduates of foreign medical schools may continue to add to the supply. About 1,500 United States citizens were studying medicine abroad in 1955, and the number of foreign-trained physicians licensed annually rose from about 300 in 1950 to 900 in 1955.

Despite this expansion in supply, the outlook for physicians is expected to continue to be excellent throughout the early 1960's. The majority of new doctors will be needed to replace the more than 4,500 physicians who die or retire each year. The rest will be needed to keep pace with rising demands for medical services.

In the long run, the country's expanding population, the rising health consciousness of the general public, and the trend toward higher standards of medical care point toward a steady increase in the demand for physicians. Extension of prepayment plans for medical care and hospitalization, continued Government provision of medical care for veterans and members of the Armed Forces, and the growing use of preventive health measures such as periodic physical examinations in industry will bring about a need for more doctors. Expanded medical research activities will require more trained investigators; public health programs will need qualified administrators; and medical schools will have openings for additional faculty members.

The rising demand for physicians' services will be offset to some extent by advances in medical science and more efficient use of medical personnel. The introduction of new drugs and medical techniques, the more extensive use of assistants trained in other health occupations, and the increasing proportion of patients treated in hospitals rather than at home will probably enable individual physicians to care for more patients. Improved roads and transportation facilities as well as the movement of people from farms to urban areas will continue to decrease the time needed to visit patients. In addition, the growing tendency of doctors to work together in groups is expected to result in a more effective use of the physician's time. Nevertheless, population expansion and the general rise in use of medical services are expected to outweigh any lessening in demand arising from other developments. For all these reasons, the outlook over the long run is very bright for young people who have proper qualifications and are able to gain admittance to medical school.

Women physicians, who constitute about 5 percent of the profession, will continue to find good opportunities as general practitioners and as specialists in pediatrics, psychiatry, obstetrics, gynecology, internal medicine, and anesthesiology. In 1956, almost 6 percent of all medical school students were women. Only 3 schools had no women in the freshman class; 1 school accepted only women students.

Earnings and Working Conditions

New graduates serving as interns in 1955 earned, on the average, $120 a month in hospitals affiliated with medical schools and $170 a month in other hospitals. In many cases, interns also received room, board, and other maintenance. During the first year or two of independent practice, physicians may earn little more than the minimum needed to pay expenses but, as a rule, their earnings rise rapidly as the practice develops.

In 1951, the average income above expenses of all physicians—excluding hospital interns and residents—was $12,500 a year. Earnings of individual physicians depend on such factors as size of community and region of the country in which the practice is located, the income level of the people cared for, and the physician's skill and personality as well as length of experience. As a rule, physicians engaged in private practice earn more than those in salaried positions, and specialists usually earn considerably more than general practitioners.

Many physicians work long and irregular hours; half the physicians in private practice worked 60 or more hours a week, according to a 1949 survey. Most specialists work fewer hours each week than general practitioners. As doctors grow older, they tend to work shorter hours. Many continue in practice well beyond 70 years of age.

Where To Go for More Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of medical examiners of that State. Lists of approved premedical and medical schools, as well as general information on medicine as a career, may be obtained from:

Council on Medical Education and Hospitals, American Medical Association,
535 North Dearborn St., Chicago 10, Ill.

Association of American Medical Colleges,
2530 Ridge Ave., Evanston, Ill.

Pharmacists

(D. O. T. 0–25.10)

Nature of Work

Pharmacists must understand the composition, manufacture, and uses of drugs and be able to test them for purity and strength. Their duties include filling prescriptions ordered by physicians, storing and distributing medicines and narcotics, and advising doctors on the uses and availability of drugs. Compounding—the actual mixing of ingredients—is only a small part of the present-day pharmacist's work, since many drugs are now produced by manufacturers in the final form used by the patient.

Many pharmacists working in drugstores perform a variety of sales and managerial duties besides dispensing drugs. They may hire and supervise salesclerks, arrange window displays, and purchase and sell magazines, candy, and other merchandise in addition to medicines. Some retail pharmacists, however, operate prescription pharmacies which handle only drugs and medical supplies. Pharmacists in hospitals fill prescriptions and advise the medical staff on the selection and effects of drugs; they may also manufacture sterile solutions, purchase medical supplies, teach in schools of nursing, and perform administrative duties. Some pharmacists employed as "detail men" by drug manufacturers and wholesalers introduce new drugs to doctors and sell pharmaceuticals to other pharmacists. Others teach in colleges, perform research, supervise the manufacture of pharmaceuticals, develop new drugs, write for pharmaceutical journals, or do administrative work.

Where Employed

About 99,000 of the 111,000 registered pharmacists in the United States in early 1956 worked in drugstores. Half the 99,000 owned their own drugstores or were partners in a pharmacy; the remainder were salaried employees with no financial interest in the pharmacies in which they worked. Of the other 12,000 pharmacists, the greatest number were employed by drug manufacturers and wholesalers and the next largest number worked for hospitals. Approximately 600 were civilian employees of the Federal Government, working chiefly in hospitals and clinics of the Veterans Administration and the United States Public Health Service. In addition, some served as pharmacists in the Armed Forces, taught in colleges of pharmacy, or worked for State and local government agencies and other employers.

Although most small towns have at least one drugstore with a pharmacist in attendance, members of the profession are concentrated in or near big cities. About 40 percent of the pharmacists are in New York, Pennsylvania, California, Illinois, and Ohio.

Training and Other Qualifications

A license to practice pharmacy is required in all States and the District of Columbia. An applicant must be a graduate from an accredited school, pass a State Board examination and, in most States, must also have 1 year of practical experience under the supervision of a registered pharmacist. In about 10 States, part or all of this experience must be acquired after graduation. All States, except New York, California, and Florida will usually grant a license without an examination to properly qualified pharmacists already licensed by another State.

Four years of study beyond high school is the usual requirement for graduation from pharmacy college, although a longer period of training is required by several schools. Some pharmacy colleges admit students directly from high school and provide all the education necessary for graduation. Other pharmacy schools provide only 3 years of professional instruction and require all entrants to have completed 1 or 2 years of prepharmacy training in an approved college. Emphasis in prepharmacy training is usually on mathematics and basic sciences such as chemistry and biology. Beginning in April 1965, each accredited pharmacy college will issue degrees only to those with 5 years of college education, including at least 3 years in pharmacy school. The first students affected will be those who start their college training in 1960.

The bachelor's degree awarded upon graduation from pharmacy college is sufficient educational qualification for most positions in the profession. However, the master's or Ph. D. degree in pharmacy or related fields such as pharma-

ceutical chemistry, pharmacology, pharmacognosy, or pharmacy administration are usually required for research work and college teaching. Graduate training is also considered desirable for pharmacists planning to work in hospitals. Those interested in becoming hospital pharmacists can sometimes secure 1- or 2-year hospital internships which, in some cases, provide for graduate study leading to an advanced degree.

Prospective pharmacy students should have a good high school background in mathematics and science. In addition, orderliness and a liking for detail are desirable qualities for young people entering the profession. For those planning to become retail pharmacists, the ability to deal with people and manage a business are of special importance. In 1956, many of the 75 pharmacy colleges were not filled and qualified applicants could usually expect to be accepted.

Most pharmacists begin as employees in retail drugstores. After securing some experience, those with sufficient funds sometimes open their own pharmacies or buy established drugstores. A pharmacist who gains experience in a chain drugstore may advance to store manager or to a higher executive position within the company.

Employment Outlook

The supply of pharmasicts in 1956 was generally sufficient to meet the demand for their services in most parts of the country. As a rule, new graduates could find work readily and, at the same time, employers were usually able to hire all the pharmacists they needed. Despite this overall balance of supply and demand, not enough pharmacists with graduate training were available for college teaching and laboratory research.

Most beginning pharmacists will probably continue to find employment easily throughout the 1950's. From 3,000 to 4,000 openings are expected to occur each year as pharmacists leave the profession owing to death, retirement, or other reasons. Furthermore, the anticipated gradual increase in positions for pharmacists is expected to create enough additional jobs to absorb the rest of each year's graduates.

In the long run, a moderate but steady increase is expected in the employment of pharmacists. The country's expanding population—especially the growing number of old people and children—and the rising standard of medical care point to an ever-increasing demand for pharmacists' services. The trend toward bigger drugstores is expected to continue, and some new stores will be added, particularly in new residential areas or suburban shopping centers. Also, in view of the trend toward shorter working hours, many drug stores will hire additional pharmacists. Continued expansion in pharmaceutical manufacturing and research is expected to provide more opportunities for pharmacists not only in production and research but also in distribution and sales positions. Employment in hospitals will probably rise significantly with the construction of additional facilities and the more extensive use of pharmacists for hospital work. In both the drug industry and hospitals, the demand will be greatest for pharmacists with graduate training. Although many factors point toward continuous growth in this profession, it should be borne in mind that employment of pharmacists is closely related to the prosperity of the retail drug industry which, in turn, depends on the general level of economic activity.

Women, who represent about 6 percent of all pharmacists, will continue to find their best opportunities in laboratory work and hospital pharmacy, although some are employed in all branches of the profession. Women students are accepted by all colleges of pharmacy and, in 1955, constituted 10 percent of both undergraduate and graduate enrollments.

Earnings and Working Conditions

Beginning pharmacists employed in drugstores generally earned between $80 and $110 a week in 1956; those operating their own drugstores had a much wider range of earnings. It is difficult to generalize on pharmacists' earnings because they are greatly affected by length of workweek, size and geographic location of store, and many other factors. Young pharmacists working in hospitals and drug manufacturing firms generally earned from $4,000 to $5,000 a year. The usual entrance salary for pharmacists in the Federal Civil Service was $4,525.

Retail pharmacists generally work more than the standard 40-hour week. Drugstores are often open in the evenings and on weekends and most States require a registered pharmacist to be in attendance at all times. Despite the trend toward shorter hours, 45 or 48 hours is still often the basic week for salaried retail pharmacists and many

work 50 or more hours a week. Self-employed pharmacists often work longer hours. Those who teach or work for industry, Government agencies, or hospitals have shorter working hours.

Where To Go for More Information

Current requirements for licensure in a particular State may be obtained from the Board of Pharmacy at the State capital.

Information on pharmacy as a career may be obtained from:

American Pharmaceutical Association,
2215 Constitution Ave., Washington 7, D. C.

Information on entrance requirements, curriculums, and scholarships is available from the dean of any college of pharmacy. A list of colleges may be obtained from:

American Council on Pharmaceutical Education,
77 West Washington St., Chicago 2, Ill.

Dentists

(D. O. T. 0–13.10)

Nature of Work

Dentists are concerned with preventing and curing tooth and gum disorders. They locate and fill cavities, straighten crooked teeth, take X-rays of the mouth, and treat gum diseases. Dentists also extract teeth and provide artificial ones to meet the requirements of each patient. In addition, they examine the mouth for diseases which may affect a patient's general health. Dentists spend most of their time taking care of patients, but they also may devote some time each day to laboratory work. The bulk of the laboratory work, however, is generally sent to commercial firms which make the dentures, inlays, or other appliances ordered by the dentist.

Most dentists provide all types of dental care and are regarded as general practitioners; only about 8 percent are recognized as specialists. Approximately half the specialists are orthodontists concerned with straightening crooked teeth. The next largest number, oral surgeons, perform operations on the mouth and jaws. The remainder specialize in periodontology (treating the tissues supporting the teeth), prosthodontics (making artificial teeth or dentures), pedodontics (children's dentistry), oral pathology (diseases of the mouth), and public health dentistry.

Only 3 out of every 100 dentists are primarily employed in teaching, research, or other work that does not involve "chairside" practice. However, many dentists in private practice teach or engage in research on a part-time basis.

Where Employed

Ninety percent of the 89,000 dentists professionally active in mid-1956 were in private practice.

Some dentists specialize in care of children's teeth.

Of the remainder, about 6,000 served as commissioned officers in the Armed Forces; 1,200 worked for the Federal Government—chiefly in the hospitals and clinics of the Veterans Administration and the Public Health Service; and about 1,700 held full-time positions in schools, hospitals, or State and local health agencies. Women dentists constituted only 2 or 3 percent of the profession.

Dentists are concentrated in big cities and in certain regions of the country. In 1955, 4 States (New York, California, Pennsylvania, and Illinois) had almost 40 percent of the dentists

whereas 21 States had only 10 percent. The Middle Atlantic States (Delaware, District of Columbia, Maryland, New Jersey, New York, Pennsylvania, and West Virginia) have the highest ratio of dentists to population, with 1 dentist for every 1,40? persons. New England has the second highest ratio and the Far West, the third. At the other extreme, is the Southeast with only 1 dentist for every 3,076 residents.

Training and Other Qualifications

A license to practice dentistry is required in all States and the District of Columbia. To qualify for a license, a candidate must be a graduate of an approved dental school and pass a State Board examination. One State, Delaware, also requires new graduates to serve 1 year of hospital internship. Most State licenses permit dentists to engage in both general and specialized practice. In nine States, however, a dentist cannot call himself a "specialist" unless he has been licensed as such after passing a special State examination.

In planning a career in dentistry, the student should obtain information on requirements for licensure in the State in which he hopes to practice. Educational and other requirements differ somewhat among the States. Few States issue a license without further examination even though a dentist holds a license in another State.

Two years of predental college work followed by 4 years of professional training in a dental school are the minimum educational qualifications for dentistry; 7 of the 46 dental schools in operation in 1956 required 3 years of predental study. Predental education must include at least one half-year course in organic chemistry and a full-year course in each of the following: English, biology, physics, and inorganic chemistry.

In dental college, the first 2 years are usually devoted to classroom instruction and laboratory work in such basic sciences as anatomy, bacteriology, and pharmacology. The last 2 years are spent chiefly in gaining experience with patients in the school's dental clinic. The degree of Doctor of Dental Surgery (D. D. S.), awarded by most dental colleges, or the Doctor of Dental Medicine (D. D. M.) degree, conferred by a few schools, is sufficient for entering general practice.

Those interested in research or teaching often take graduate work in a basic science. Dentists desiring to become certified specialists need 2 or 3 years of graduate education and several years of specialized experience in order to qualify for specialty board examinations. Graduate training may be obtained at graduate schools of dentistry and also by serving an internship or residency at 1 of the 175 approved hospitals which offer these programs.

Considerable competition exists for admittance to dental schools. Despite the opening of several new dental colleges, more than twice as many students applied as could be admitted to the freshman class in 1956. In selecting students, dental schools give considerable weight to college grades and amount of college education; over 75 percent of the students enrolled in 1955 had at least 3 years of college education and more than 40 percent had a bachelor's degree. In addition, all dental schools participate in a nationwide dental aptitude testing program, and scores earned on these tests are taken into consideration along with other information gathered about the applicant through recommendations or interviews. Place of residence is also important as about one-third of the dental schools are State-supported institutions which usually give preference to residents of the State in which the school is located.

The profession of dentistry requires a combination of manual skills and a high level of intelligence. The dentist should have a good visual memory, excellent judgment of space and shape, delicacy of touch, and a high degree of manual dexterity as well as the ability to master scientific subjects. A liking for people and a good business sense are helpful in achieving success as a practitioner.

The majority of newly qualified dentists open their own offices or purchase established practices. Some start as assistants to other dentists in order to gain experience and to save the money required to equip an office. Dentists entering the Armed Forces are commissioned as first lieutenants or lieutenants (j. g.) and may progress to the rank of colonel or higher. Graduates of recognized dental schools are eligible for Federal Civil Service positions and for commissions in the U. S. Public Health Service.

Employment Outlook

Opportunities for dentists were excellent in 1956. There was a shortage of practitioners except in some very large cities; Federal agencies and

State and local public health organizations found it difficult to recruit sufficient dentists; and many dental schools reported unfilled teaching and research positions. In addition, the Armed Forces absorbed about three-fourths of the new graduates as replacements for dentists completing military service. Opportunities for beginning practice were best in the West and South where the demand for additional dentists was the greatest.

During the late 1950's and the early 1960's the demand for dental services is likely to grow faster than the supply of new dentists. Although the number of dentists graduated each year is expected to increase from about 3,000 in 1956 to an estimated 3,700 graduates annually by 1965, most of these new graduates will be needed to replace those who die or retire. To keep pace with anticipated population expansion, many more graduates will be needed each year. These additional dentists cannot be trained unless there is a greater increase in dental school facilities than was contemplated in 1956.

A steady increase is expected in the demand for dental services over the long run. In addition to the country's expanding population, growing recognition of the importance of obtaining regular dental care and the trend toward budget payment and dental prepayment health plans will cause a continuing rise in the demand for practitioners. Expanded dental research activities will require more trained investigators; dental public health programs will need qualified administrators; and dental colleges will have openings for additional faculty members. A number of dentists will continue to serve in the Armed Forces. Although better dental hygiene and fluoridation of community water supplies may prevent some tooth and gum disorders, such measures—by preserving teeth that might otherwise be extracted—may tend to increase rather than decrease the demand for dental care over the long run. Continued high levels of national income will make more people visit dentists regularly; on the other hand, a major economic depression would undoubtedly cause a drop in the use of dental services.

The introduction of new techniques, equipment, and drugs as well as more extensive and effective use of dental hygienists, assistants, and laboratory technicians will probably enable individual dentists to care for more patients. Nevertheless, population expansion and the huge backlog of unmet dental needs coupled with the general rise in use of dental services are expected to far outweigh any lessening in demand arising from other developments.

Despite the overall shortage of dentists, there is considerable variation in the success of individual practitioners. One of the major factors in determining success is location. In general, people who are well educated and those employed in relatively well-paying jobs are most likely to visit dentists regularly. Also, a practice can be developed most quickly in small towns where the new dentist can easily become known and where there is less competition with established practitioners. The dentist planning to open an office should, therefore, choose his location carefully and consider the number of other dentists in the area, as well as the size, income, and educational level of the population.

Earnings and Working Conditions

During the first year or two of practice, dentists often earn little more than the minimum needed to pay expenses, but earnings rise rapidly as the practice develops. In 1955, the average income above expenses for all self-employed dentists was about $12,500 a year, compared to $9,300 for all salaried dentists, according to an American Dental Association survey. Approximately 60 percent of all dentists earned between $7,000 and $17,000 annually; 20 percent earned less than $7,000; and 20 percent earned more than $17,000. Two percent of all dentists reported incomes of $30,000 or more. Specialists generally earned considerably more than general practitioners, with orthodontists reporting the highest average incomes.

Dentists in the Far West and South had higher average incomes than those in other regions of the country. Dentists' incomes tended to be lowest in New England and the Middle Atlantic States. Practitioners in medium-size cities (50,000 to 500,000 population) earned more, on the average, than those in either larger or smaller cities.

Most dental offices are open 5 days a week and some dentists have evening hours. Although dentists averaged about 43 hours of work a week, almost one-fourth of those surveyed in 1955 reported they spent 50 hours or more a week in the office. The hours of work, however, are usually determined by the dentist himself, and many dentists work fewer hours as they grow older. For this

reason, a considerable number continue in part-time practice beyond 65 years of age.

Where To Go for More Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. A list of State boards, as well as information on dentistry as a career, may be obtained from:

American Dental Association,
222 East Superior St., Chicago 11, Ill.

Medical X-Ray Technicians*

(D. O. T. 0–50.04)

Nature of Work

Medical X-ray technicians operate several types of X-ray equipment which photograph, or make visible on a screen, internal parts of the body which the physician wishes to examine for the purpose of diagnosing disease or injury. X-ray machines are used to detect the presence of foreign matter or injury and to discover any malformation or malfunctioning of various parts of the human body. In addition, they may be used for the treatment of various diseases or injuries, particularly cancer and diseases of the skin. The detection of disease or injury by means of X-ray is usually called "diagnostic" X-ray, and treatment by X-ray is usually called "therapeutic" X-ray.

Medical X-ray technicians generally work under the direction of a physician. Sometimes this physician is a specialist in the use of X-rays who is called a "radiologist." In taking photographs, technicians position the patient under the X-ray machine and regulate the controls to expose the film. Because they are partly responsible for the care and safety of patients undergoing treatment, they must adjust and manipulate the equipment in such a way as to minimize hazards of electric shock, burns, and extraneous radiation. For special types of X-ray work (for example, fluoroscopy), the technician may prepare the patient by administering an X-ray "opaque," such as barium salts. This opaque is a harmless chemical substance which the patient swallows in order to shade various parts of the anatomy to give proper visibility for X-ray purposes. In therapeutic work with X-rays or radium (treating diseased and affected areas of the body by exposure to X-ray or radium), the technician works under the direct supervision of a radiologist.

Some X-ray technicians working in hospitals or medical laboratories that provide services to physicians learn to operate other kind of apparatus, in addition to those related to radiological work. Equipment for diagnosing heart disease or brain damage and for determining basal metabolism are among those most commonly found in combination with the operation of X-ray and fluoroscopic apparatus. Thus, an X-ray technician may learn, on the job, how to operate the electrocardiograph, the electroencephalograph, or the basal metabolism apparatus.

Additional duties of technicians consist of developing and drying X-ray film and keeping records of services performed for each patient.

Where Employed

In 1956, some 50,000 to 60,000 persons were employed as medical X-ray technicians, of whom almost 18,000 were registered with the American Registry of X-Ray Technicians. These registered technicians are permitted to use the letters R. T. (ARXT) after their names, indicating that they have secured at least the minimum required experience and passed the prescribed examination. Women comprised about 70 percent of these registered technicians in 1956 and, probably, were a majority of all medical X-ray technicians.

About a fourth of all medical X-ray technicians were employed in hospitals in 1956. The remainder worked in medical laboratories, physicians' and dentists' offices, public health facilities, and military establishments. Most technicians work in large cities where there is concentration of medical facilities and services; however, some are found in smaller areas where a hospital or other medical facility operates. In addition, the widespread use of the X-ray for routine medical examinations in various health, welfare, and industrial programs of preventive medicine has brought about the establishment of small mobile X-ray teams.

*Prepared by the Women's Bureau, U. S. Department of Labor.

Training and Other Qualifications

The most widely known and accepted training course for X-ray technicians is that offered by hospital schools approved by the Council of Medical Education and Hospitals of the American Medical Association. In 1956, there were some 450 of these schools in operation throughout the United States. Generally, they required a high school education as a prerequisite for a 12- to 24-month course of training. Some, however, required additional education—in a few cases, as much as 2 years of college. Preferred applicants included graduate nurses and persons with some nurse training or college science courses. In general, some knowledge of physics, chemistry, algebra, geometry, and biology is considered helpful background for the technical courses included in X-ray technology. The cost of training in approved hospital schools, aside from maintenance expenses, is relatively low. Almost two-thirds of these schools charged no tuition in 1953, and most of the remainder charged modest fees ranging up to $100. A few were more expensive, but many of the schools paid their students some sort of stipend.

Besides the approved hospital courses, one can learn to operate X-ray equipment through training offered on the job, or through private schools of medical and X-ray technology. Those who receive only partial training, however, may have difficulty in qualifying for X-ray jobs with a wide range of assignments or responsibility.

To meet minimum requirements for registration with the American Registry of X-Ray Technicians, technicians must have had a high school education or the equivalent thereof and 1 year of training or experience under the direction of a recognized radiologist, plus either (a) 1 additional year of experience in an acceptable X-ray department under the direct supervision of a physician specializing in radiology, or (b) 2 additional years under the direction of a physician who is not a radiologist. Technicians must also pass an examination given by the Registry.

Employment Outlook

A shortage of qualified X-ray technicians was evident in 1956, especially in communities with small hospitals. The shortage was due, in large part, to the rising demand for technicians to staff rapidly expanding hospital and medical programs. Also, the expansion of public health programs and services and the growing interest in preventive medicine have increased the number of opportunities in government employment.

During the past 20 years, there has been considerable activity in the health field. Hospital facilities have been continually expanding; significant technological advances have occurred in the diagnosis and treatment of diseases and injuries; and the expanded use of X-ray equipment has been a part of this advance. Originally confined to bone diagnosis and locating foreign bodies, X-ray equipment is now widely used in such fields as tuberculosis detection, examination of teeth, and treatment of cancer, sinusitis, and certain skin diseases. Industrial establishments, health departments, tuberculosis hospital, and health associations in many parts of the country are organized for the routine X-raying of large groups of people as part of a program for disease prevention and control. Many insurance companies now include a chest X-ray as part of the physical examination required for an insurance policy. All of these developments contribute to a growing need for medical X-ray technicians.

The demand for X-ray technicians is expected to continue well into the 1960's. It is estimated that approximately 15,000 technicians will be needed through 1961 to fill new positions. In addition, annual replacement needs will be relatively high because of the large number of women in the field, many of whom can be expected to leave for marriage and family reasons. The supply of well-trained personnel will probably be insufficient. As a result, many technicians will be trained on the job in a limited number of skills, and technicians with all-round skills and experience will have very good employment opportunities. In order to supplement full-time workers, employers will continue to offer opportunities for part-time work, and mature persons with recognized training or experience will have good chances for employment.

On the whole, opportunities for advancement for X-ray technicians are fairly limited. Those employed in large X-ray departments usually have the chance to qualify for the job of chief X-ray technician or, perhaps, assistant to the chief. They also may be able to advance in their positions by qualifying to teach X-ray techniques to students in training. Authorities in the field believe that, in general, technicians with a variety

of skills and experience have the best opportunities for promotion.

Earnings and Working Conditions

Starting salaries for registered X-ray technicians were reported in 1956 at about $250 a month. Nonregistered technicians reportedly started at $200 a month or less. Experienced X-ray technicians were receiving about $300 to $400 a month in 1956, while chief X-ray technicians earned $400 or more. A majority of medical X-ray technicians in the Federal Civil Service in 1954 were classified in positions that were paying between $3,415 and $4,480 in 1956. Versatility and the ability to supervise or instruct others are important for the better paying positions.

Most full-time technicians work 8 hours a day and 40 to 44 hours a week, and most are covered by the vacation and sick leave provisions of the organizations which employ them.

Good health and vigor are important requirements for this occupation. Those who work with X-rays may be subject to the effects of radiation and may become anemic unless precautions established by radiologists are rigidly observed. Because of the hazards involved, great care is usually exercised to protect the technician. Safety devices, regular blood checks, and attention to diet, fresh air, and sunshine are important to persons engaged in this work.

Where To Go for More Information

Additional information about medical X-ray technicians is given in the following publication:

The Outlook for Women as X-Ray Technicians. Women's Bureau Bull. 203-8, 1954. Superintendent of Documents, Washington 25, D. C. Price 25 cents.

Information, particularly on registration and approved hospital schools, may be obtained from:

The American Registry of X-Ray Technicians,
Metropolitan Building, Minneapolis 1, Minn.

The American Society of X-Ray Technicians,
16 14th Street, Fon du Lac, Wis.

Medical Laboratory Technicians*

(D. O. T. 0–50.01)

Nature of Work

Medical laboratory technicians assist physicians in the diagnosis and treatment of disease by performing a variety of laboratory tests. They work under the direction of a physician or other laboratory supervisor, such as a medical scientist (bacteriologist, biochemist, hematologist, or serologist) or a highly trained laboratory technician (medical technologist). Whereas some technicians conduct only standard medical tests ranging from relatively routine tests which can be learned on the job to more difficult tests requiring some post high school training in science and laboratory techniques, other technicians (medical technologists) may perform a wide variety of difficult clinical tests which generally require college-level training as well as practical experience. A technician may take blood counts, make urinalyses, prepare vaccines and serums, give biological skin tests, measure basal metabolism, analyze water or food products for bacteria, prepare tissue specimen for microscopic examination, or analyze stomach content.

In general, medical technologists make difficult examinations with a minimum of supervision, whereas technicians perform more limited tests under relatively close supervision. Customarily, technologists and technicians are responsible to a pathologist (a physician who specializes in the nature and causes of disease); however, technicians often work under the direct supervision of a technologist. Most medical technologists are qualified to work in all fields of medical science, but some prefer to specialize in a particular field, such as bacteriology, biochemistry, serology, or hematology.

In a small laboratory, a technician may work on a variety of tests. In a large establishment, however, each technician is usually assigned to a specialist who conducts only certain types of tests. Most medical laboratory technicians, regardless of skill and training, perform tests or studies in connection with examinations of patients; some do research on new drugs or treatments or on the improvement of laboratory techniques; and some teach.

*Prepared by the Women's Bureau, U. S. Department of Labor.

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A medical laboratory technician using microscope.

Where Employed

In 1956, some 40,000 to 50,000 persons were employed as medical laboratory technicians, of whom about 18,000 were medical technologists registered with the American Society of Clinical Pathologists. Women comprised almost 90 percent of the registered medical technologists and, probably, more than half of the technicians. An increasing number of men have been entering both fields in recent years, however.

About two-thirds of all medical laboratory technicians (and technologists) work in hospital laboratories. The remainder work in laboratories of private physicians, public health departments, clinics, or research institutions. Some are employed as instructors in hospital or private schools of medical technology. Most work in large metropolitan areas since this is where the largest medical facilities are located, but some will be found wherever a hospital or medical laboratory exists.

Training and Other Qualifications

Training for medical laboratory technicians ranges from on-the-job instruction for the routine technician or laboratory assistant to a 4-year college program leading to a bachelor of science degree for the highly trained medical technologist. High school graduates who have taken courses in biology or chemistry may secure beginning jobs as laboratory assistants or helpers and learn some of the routine tests on the job. Or, they may take a 1- or 2-year course in a private school of medical technology, qualifying them for work as a medical laboratory technician. In general, however, the increasing complexity of medical laboratory science requires more theory and information than most high school or short-term courses provide. Therefore, some college or university training followed by, or combined with, a recognized course in medical technology is recommended.

The most widely recognized medical technologists are those designated as MT (ASCP)—Medical Technologists (American Society of Clinical Pathologists). This official title may be used only by those persons who satisfy the specific education and training requirements established by the American Medical Association and pass the examination for registration given by the Board of Registry of Medical Technologists of the American Society of Clinical Pathologists.

The minimum training necessary for a person desiring to become a Medical Technologist (ASCP) includes 2 years of accredited college work and 12 to 24 months of training in a hospital school approved by the Council on Medical Education and Hospitals of the American Medical Association. In 1955, more than 600 hospital schools offering instruction in medical laboratory work had been approved by the Council. About three-fourths of the approved schools accepted applicants with 2 years of college; the remainder required more education for entrance. Length of training time in approved hospital schools ranged from 12 to 24 months, with 12-month courses most common. The cost of training, aside from maintenance expenses, was relatively low. About two-thirds of the approved schools charged no tuition, according to a survey made in 1953. One-sixth charged from $20 to $100 for the complete course, and fewer than one-tenth reported fees ranging from $105 to $425. A small number of schools, which combined hospital training with a college-degree program, required the regular tuition fee of the affiliated university. Graduates of these approved programs are eligible to take a qualifying examination for registration with the Regis-

try of Medical Technologists of the American Society of Clinical Pathologists.

Many employers prefer, or require, that prospective employees be registered, or eligible for registration, with the American Society of Clinical Pathologists. Although graduates of some private schools are eligible for registration as medical technologists with the American Medical Technologists (a different organization from the one previously mentioned), they do not carry the MT (ASCP) title, and, therefore, are not accepted as fully trained technologists by certain hospitals and clinics. Furthermore, the present trend is toward a 4-year college program which combines an approved hospital-school course with academic education, leading to a bachelor of science degree in medical technology. Such training is most likely to be required for the better positions. Of course, in the few States where licensing is necessary for medical laboratory technicians, the legal requirements specified by the State must be met by any technician or technologist working in that State.

Some of the important personal traits needed for medical laboratory work are accuracy, dependability, manual dexterity, and ability to follow directions. Good eyesight is a basic physical requirement.

Advancement opportunities depend principally upon the level of training and experience of the individual and the size of the organization where employed. Persons without college training are likely to have limited opportunities for advancement. In a large organization, a competent technologist or technician may become a supervisor of a group of other technicians and assistants, or perhaps, technical head of the laboratory. After appropriate experience, one may become a specialist in bacteriology, biochemistry, serology, or hematology. Those interested in teaching may take advantage of new opportunities developing in the training of new workers. Even for thoroughly trained technologists, however, advancement is largely limited to supervision or specialization, since most positions above these levels are filled by medical scientists with advanced degrees and physicians who qualify as pathologists.

Employment Outlook

A substantial shortage of medical laboratory technicians (especially those qualified for more difficult work than routine clinical tests) was evident in 1956. Because shortages before this time had been reported—for example, a survey of hospitals in 1952 showed 15 percent of their laboratory technician jobs vacant—a nationwide campaign to recruit young people into the field was undertaken in 1954. Despite this effort, the shortage is expected to continue because of the rising demand for technicians and technologists to staff rapidly expanding hospital and medical programs. In the Federal Government, expanding medical facilities and health services and increased emphasis on health research have created a need for additional technicians.

The demand for all levels of medical laboratory technicians is expected to increase for the remainder of the decade and into the 1960's. Since many of the workers in this field are young women, who may be leaving their jobs for marriage and family responsibilities, many job openings will be created. In addition, it has been estimated that twice as many technicians with some college training will be needed in the early 1960's as there were employed in 1956 because of the increasing complexity of laboratory services and experimentation with new drugs and techniques. The supply of college-trained personnel will undoubtedly be insufficient to meet these needs owing in part to the limited possibilities of expanding training facilities. In view of this situation, technicians without college training will continue to have good opportunities for employment, particularly in jobs requiring only limited theoretical knowledge and skill. Also, opportunities for part-time employment will continue to exist for persons needed to supplement full-time staffs.

Mature persons who are adequately trained or experienced will continue to have good employment opportunities, since the current shortage of well-qualified personnel is expected to increase. Although some of the approved training schools do not accept applicants over 30 years of age, several have no age restrictions on admissions.

Over the long run, employment for medical laboratory technicians is expected to continue to expand. Increased medical research and advances in medical knowledge and practice depend upon laboratory work and will require a growing number of laboratory technicians. The continuing interest in preventive medicine and health and hospitalization insurance, coupled with the rising standard of living, will further increase the need

for hospitals, clinics, and public health services, thereby expanding the demand for medical laboratory technicians.

Earnings and Working Conditions

A salary survey conducted by the Registry of Medical Technologists of the American Society of Clinical Pathologists in 1953 showed that the median (average) salary reported by 6,700 registered medical technologists was between $3,300 and $3,600 a year. About one-fifth earned less than $3,000, and about one-sixth, $4,200 or more. Adequate data are not available for 1956, but one report from the field indicates that the majority of technologists were earning more than $3,500 a year in 1956. A majority of medical technicians in the Federal service in 1954 were classified in positions that were paying between $3,670 and $4,480 in 1956.

Starting salaries for medical technologists with some college training were reported in 1956 to range between $275 and $300 a month but were somewhat lower for technicians with limited training and skill.

Salaries vary from laboratory to laboratory, of course, but they are likely to be determined largely by the level of skill and responsibility of the positions. Thus, the worker with all-round skills is likely to command higher pay than one who has experience with only a limited number of tests.

Most full-time laboratory technicians work 8 hours a day and either 40 or 44 hours a week, and most are covered by the vacation and sick-leave provisions of the organizations which employ them. Where night or emergency work is required, there are usually provisions for extra pay or matching time off.

Few hazards exist in laboratory work because of the high degree of care exercised in the handling of specimens, materials, and equipment. However, technicians must be willing to work in surroundings where unpleasant odors, diseased tissue, and blood are often present. Proper methods of sterilization and of handling bacteria and tissue must be observed in order to prevent the spread of disease.

Where To Go for More Information

Additional details about medical technologists and technicians, as well as some related medical laboratory jobs are given in the following publication:

> Employment Opportunities for Women as Medical Technologists and Laboratory Technicians. Women's Bureau Bull. 203–4, 1954. Superintendent of Documents, Washington 25, D. C. Price 25 cents.

Information, particularly on the MT (ASCP) and approved hospital schools, may be obtained from:

> Registry of Medical Technologists of the American Society of Clinical Pathologists,
> 700 South Council St., Muncie, Ind.

Chiropractors

(D. O. T. 0–39.90)

Nature of Work

Chiropractic is a system of treatment based on the belief that the nerve system largely determines the state of health of the human body and that any interference with this system impairs normal functions and lowers the body's resistance to disease. Chiropractors treat their patients primarily by specific adjustment of parts of the body, especially the spinal column. Many also use such supplementary measures as diet, exercise, rest, water, light, and heat. Because of the emphasis on the spine and its position, most chiropractors use X-ray extensively in their practice. Chiropractic as a system of healing does not include the use of drugs or surgery.

Where Employed

More than 25,000 chiropractors were employed in the United States in 1956, according to an estimate by The National Chiropractic Association. The greatest numbers were engaged in independent private practice. Some were employed by athletic organizations and industrial firms; others taught or did research work at chiropractic schools. A few worked on the staffs of chiropractic clinics or as salaried assistants to established practitioners. About 40 percent of all chiropractors were located in California, New York, Texas, and Ohio.

Training and Other Qualifications

Most States and the District of Columbia regulate the practice of chiropractic and grant licenses to chiropractors who meet certain educational requirements and pass a State board examination. As of 1956, four States—Louisiana, Massachusetts, Mississippi, and New York—did not regulate the practice of chiropractic nor issue licenses to chiropractors.

The type of practice permitted and the educational requirements for licensure vary considerably from one State to another. Most States require 4 years of training in a chiropractic school following high school graduation. Some also require 1 or 2 years of preparatory college work before chiropractic training. In a few States, considerably less than 4 years of chiropractic education is sufficient to qualify for a license. Qualified chiropractors licensed in one State may generally obtain a license to practice in another State without further examination.

Approximately two-thirds of the 16 chiropractic schools in the United States restrict their teaching to manipulation and spinal adjustments. The others offer a broader curriculum including training in such subjects as chiropractic physiotherapy and clinical nutrition. In the 7 chiropractic schools approved by the National Chiropractic Association, the first 2 years of the 4-year curriculum are devoted chiefly to classroom and laboratory work in subjects such as anatomy, physiology, and biochemistry. The last 2 years are spent in obtaining practical experience in the schools' clinics. The degree of doctor of chiropractic (D. C.) is awarded by all schools to students completing chiropractic training.

Most newly licensed chiropractors open their own offices or purchase an established practice. Some start as assistants to other chiropractors in order to acquire experience and funds. A considerable financial investment is usually necessary to open an office and equip it properly. Among the personal qualities considered desirable for a practitioner is the ability to deal with people sympathetically. The work does not call for unusual strength or endurance but does require considerable dexterity with the hands.

Employment Outlook

The success of the new practitioner will depend in large part on proper selection of a location for practice. Opportunities for beginning chiropractors will continue to be best in those parts of the country where chiropractic is most fully accepted as a method of treatment. Moreover, small towns or suburban areas, where the young practitioner can become known more quickly than in a big city, offer the best prospects for developing a practice.

The wide variation in community acceptance and in State laws is reflected in the concentration of chiropractors in certain areas. The highest proportion of chiropractors in relation to population is in the Western States. In 1952, there were 30 or more chiropractors for each 100,000 persons in California, Oregon, Kansas, and Colorado compared with 15 chiropractors for each 100,000 persons in the country as a whole.

Employment opportunities are expected to be greatest for new entrants who are able to meet the highest State licensing requirements, including graduation from a 4-year course of 4,000 or more hours. In view of the trend in many States toward raising the educational requirements for practicing chiropractic, thorough training will become increasingly important.

Women are expected to continue to find good opportunities in this field as some women and children prefer to go to women chiropractors for treatment. About 15 percent of the chiropractors in practice are women, and all chiropractic schools accept women as students.

Earnings and Working Conditions

In chiropractic, as in other types of independent practice, earnings are relatively low at the beginning but rise after the first few years. Incomes of individual chiropractors vary greatly with ability, experience, the income level of the community, office location, and other factors. It is estimated that the average income above expenses was over $8,000 a year in 1956.

Where To Go for More Information

Information on State licensing requirements may be obtained by writing to the State board of licensing in the capital of the State in which the individual plans to practice. General information on chiropractic as a career may be obtained from:

National Chiropractic Association,
National Building, Webster City, Iowa

Optometrists

(D. O. T. 0–39.92)

Nature of Work

Optometrists are concerned with examining eyes and with safeguarding and improving vision. They use special instruments and tests to detect vision problems and, when needed, prescribe eyeglasses, eye exercises, or other treatment that does not require drugs or surgery. Some optometrists fill their patients' prescriptions for eyeglasses and do repair work in their own laboratories. A growing number include visual training, the use of corrective eye exercises, in their practice. Some do other specialized work such as fitting persons who are nearly blind with telescopic spectacles, fitting contact lenses, studying the relationship of vision to highway safety, and analyzing lighting and other conditions that affect the efficiency of workers in industry. A few optometrists are engaged primarily in teaching or research.

Optometrists should not be confused with ophthalmologists, oculists, or opticians. Ophthalmologists and oculists are licensed medical doctors who specialize in the medical and surgical care of the eyes and may prescribe drugs or other treatment, as well as lenses. Opticians (see index) fill prescriptions for eyeglasses written by physicians who are eye specialists or by optometrists; they do not examine eyes or prescribe treatment.

Optometrist examining patient's eyes.

Where Employed

Most of the 17,000 optometrists professionally active in early 1956 were private practitioners with their own offices. However, some were salaried employees working as assistants to established practitioners or for health clinics, hospitals, optical instrument manufacturers, government agencies, and department stores. A few taught in colleges of optometry or served as optometrists in the Armed Forces.

Optometrists are located chiefly in large cities and industrial areas where many people are engaged in office work or other occupations which place a strain on the eyes. Nearly 40 percent are in the 4 States with the greatest population—Illinois, California, New York, and Pennsylvania. Many small towns and rural areas, especially in the South, have no optometrists.

Training and Other Qualifications

A license is required in all States and the District of Columbia for the practice of optometry. To obtain a license, one must be a graduate of an accredited school of optometry and pass a State Board examination. In some States, only graduates of certain accredited schools of optometry are admitted to these examinations. A student planning to become an optometrist should, therefore, choose a school approved by the Board of Optometry in the State where he expects to practice.

Five years of study beyond high school is the minimum education needed to become an optometrist. Usually this consists of 2 years of preoptometry education in an approved college followed by 3 years of training in an optometry school. Some schools require a total of 6 years—2 of preoptometry study and 4 in a school of optometry. Preoptometry courses include mathematics and the basic sciences of physics, biology, and chemistry, as well as general education courses. The curriculum in the school of optometry emphasizes not only the visual sciences but also practical training in the school's clinic. Most schools give their graduates the degree of Doctor of Optometry (O. D.) but some confer the degree

of Bachelor of Science in Optometry or Master of Optometry. Optometrists who wish to specialize often take additional training. The master's or Ph. D. degree in physiological optics or a related field is usually required for teaching and research work.

Qualifications considered important for a prospective optometrist are a liking for mathematical and scientific work, the ability to use delicate precision instruments, mechanical aptitude, and good vision. In addition, successful practice requires the ability to deal with people tactfully. In 1956, qualified applicants had an excellent chance of admittance to 1 of the 10 schools of optometry.

The majority of optometrists start either by setting up a new practice or purchasing an established one. Some begin as assistants to established practitioners, and young graduates are frequently advised to do this in order to acquire experience and funds. Although costly equipment is needed to open an office, some equipment manufacturers offer liberal time payment plans. Office location is of major importance for a successful practice. The optometrist should consider the number of optometrists and medical eye specialists in the vicinity compared with the number, occupation, age, and income level of the population requiring eye care.

Employment Outlook

In 1956, the number of optometrists was sufficient to meet the demand for optometric services in many parts of the country. Opportunities for beginning practice were generally considered best in small towns and in residential areas of cities where the new optometrist could easily become known and where competition with established optometrists and medical eye specialists was not as keen as in the business centers of large cities. Areas, especially in the South, that had no optometric services available also offered some opportunities for new graduates. Young people beginning optometric training in the late 1950's are expected to encounter less competition for desirable locations and, in general, to find more favorable opportunities upon graduation.

Enrollments in optometry schools rose sharply immediately after World War II. The number of graduates increased from a prewar level of approximately 400 in 1941 to about 1,500 in the late 1940's, as veterans completed their training. The consequent rapid expansion in the supply of professionally trained personnel limited prospects for a successful new practice in some localities in the mid-1950's. However, optometry school enrollments have dropped considerably in recent years. As a result, the supply of new optometrists in the late 1950's is expected to be less than the number needed for replacements alone; it is estimated that about 500 optometrists are needed each year to replace those lost to the profession through death, retirement, or other causes.

The demand for eye-care services will continue to grow over the long run. The importance of good vision to efficiency at work and in school is becoming more widely recognized; eye strain has been increased by many aspects of modern living; and the use of eyeglasses has come to be generally accepted. The volume of eye-care services needed will also be increased by the anticipated growth in population, especially by the expected sharp rise in the number of older people—the group most likely to need glasses. Although the expanded demand will be met in part by medical doctors who are eye specialists, optometrists will continue to supply a substantial proportion of all eye-care services.

Women optometrists, who constitute about 5 percent of the profession, have many opportunities to work as salaried assistants, especially in the field of visual training. Those in private practice have been particularly successful in work with children.

Earnings and Working Conditions

In optometry, as in some of the other health fields, a low income must be expected for the first 2 or 3 years of practice. However, as a practice becomes established, earnings usually rise significantly. In 1951, the average income above expenses was about $5,500 for self-employed optometrists under 30 years of age, according to a survey made by the American Optometric Association, and almost $11,000 for those between 50 and 59 years—the age group with the highest earnings. For all self-employed optometrists, the survey reported a mean net income of $7,750. Some successful optometrists earned over $20,000 a year.

Optometrists practicing in towns and small cities have higher net earnings, on the average,

than optometrists in large cities. However, there are some successful practitioners in big cities who have very high incomes. Although optometrists in salaried positions may at first earn more than the self-employed, earnings of those in practice for themselves usually outstrip incomes of salaried optometrists after a few years of experience.

Working hours in this profession are usually regular, though often lengthy. Many offices are open 6 days and at least 1 night each week. However, some practitioners keep only scheduled appointments. The nonstrenuous nature of the work permits professional activity to continue among those in the older age groups.

Where To Go for More Information

Additional information on optometry as a career is available from:

American Optometric Association, Inc.,
4030 Chouteau Ave., St. Louis 10, Mo.

Information on required preoptometry courses may be obtained by writing to the optometry school in which the prospective student wishes to enroll. The Board of Optometry in the capital of the State in which the student plans to practice will provide a list of optometry schools approved by that State.

Veterinarians

(D. O. T. 0–34.10)

Nature of Work

Veterinarians (doctors of veterinary medicine) are mainly responsible for the health and care of animals. They are also concerned with the quality of meat and other animal products used as food and with the control of about 80 animal diseases that can be transmitted to man.

Most veterinarians are general practitioners who diagnose and treat the injuries and diseases of both large and small animals. They advise on the care and breeding of animals and, by regular physical examinations, tests, and vaccinations, seek to prevent the outbreak and spread of diseases. Of veterinarians who are specialists, the greatest number work with pets, often operating hospitals with boarding facilities; a few are poultry specialists; others confine their practice to "prize" livestock and thoroughbred horses. Some veterinarians are engaged in inspecting meat, poultry, and other foods—a public health service of Federal and certain State governments. A small number teach in colleges or do research on animal diseases, drugs, and foods.

COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

Veterinarian taking a sample of blood from a cow for a brucellosis test.

Where Employed

About 17,000 veterinarians—5 percent of whom were women—were professionally active in the United States in 1956. Of these, over two-thirds were in private practice. The second largest number worked for the Federal Government, chiefly in the U. S. Department of Agriculture which employed about 1,600 veterinarians full time and over 5,000 on a part-time basis. Nearly 800 were commissioned officers in the Veterinary Corps of the Army and the Air Force. In addition, a substantial number worked for State and local government agencies. Some were also employed by schools of veterinary medicine, State agricultural colleges, animal food companies, and pharmaceutical companies that manufacture drugs for animals.

Veterinarians practice in all parts of the country, although they are located chiefly in States where a large percentage of the Nation's livestock is raised. States with the largest number of veterinarians in 1956 were California, with about 1,500, and New York, Illinois, Iowa, and Ohio,

with over 1,000 each. Veterinarians in rural areas deal chiefly with large animals, those in small towns usually engage in general practice, while those in cities frequently limit their practice to pet animals.

Training and Other Qualifications

A license is required in all States and the District of Columbia for the practice of veterinary medicine. To obtain a license, applicants must usually be graduates of approved veterinary schools and must pass a State Board examination. A few States also require some practical experience under the supervision of a licensed veterinarian. A limited number issue licenses without examination to veterinarians who have passed an examination in another State.

Two years of preveterinary college work followed by 4 years of professional study in a school of veterinary medicine are the minimum requirements for the degree of Doctor of Veterinary Medicine (D. V. M.). However, it may take 3 years to complete the preveterinary curriculum, which concentrates on chemistry and other science courses. The veterinary school training includes considerable practical experience with animals as well as laboratory work in anatomy, biochemistry, and other scientific and medical fields. Veterinarians engaged in research or college teaching are sometimes required to have the master's or Ph. D. degree in fields such as pathology, public health, or bacteriology, in addition to the D. V. M.

There are 17 colleges of veterinary medicine in the United States. Each year many more young people apply for admission than can be accepted. Some of the qualifications considered in selecting students are: Good scholastic records, amount and character of preveterinary training (in 1954, about one-fourth of the students selected had a bachelor's degree), a farm background, good health, and a liking for animals. Opportunities for women students are limited as most veterinary colleges are reluctant to enroll them. Since veterinary colleges are largely State supported, residents of the State in which the school is located are almost always given preference. In the South and West, regional educational plans have been developed that permit cooperating States without veterinary schools to send a few students to designated regional schools. The regional school is paid a stipulated sum by the home State of each out-of-State student. In other areas, schools may informally decide to accept a certain number of students from other States, often giving priority to applicants from nearby States without veterinary schools.

Some veterinarians begin as assistants to, or partners of, established practitioners. Many establish their own practice and start with a modest financial investment in such essentials as drugs, instruments, and a car. Those operating animal hospitals or purchasing an established practice have to make a substantial investment. Newly qualified veterinarians entering the Army or Air Force are commissioned as first lieutenants. Beginning veterinarians who are graduates of accredited veterinary schools qualify for Federal civil-service positions, such as meat and poultry inspectors, disease-control workers, and research assistants. In addition, a program conducted by the U. S. Department of Agriculture offers junior students of veterinary medicine opportunities to serve as trainees during the summer months.

Employment Outlook

The shortage of veterinarians which has existed since 1940 is expected to continue—though to a lessening extent—throughout the 1950's. In 1956, private practitioners were in great demand; the U. S. Department of Agriculture had over 150 salaried vacancies; colleges needed teachers and research workers; and many State and municipal health departments had unfilled vacancies. On the other hand, some big cities were believed to have sufficient pet practitioners.

The 7 schools established after World War II increased the supply of new veterinarians; an average of about 900 were graduated annually between 1950 and 1956. More than 400 of these were needed each year to replace men lost to the profession through death or retirement. Because many veterinarians are in the older age groups, it is anticipated that replacement needs will continue to absorb a large number of the new graduates throughout the early 1960's.

A gradual expansion in the employment of veterinarians can be expected in the long run. More veterinarians will be needed to care for the increased number of animals required to feed the country's expanding population. The trend toward suburban living is expected to bring about a large growth in the pet population and thus create a greater demand for pet animal specialists.

Emphasis on scientific methods of raising and breeding livestock and poultry will continue to increase, and public health inspection and sanitation programs are expected to grow. More teachers will be needed to meet the anticipated rise in agricultural college enrollment, and veterinary research will expand further. In addition, developing programs in international public health and atomic energy research will offer a few opportunities.

The need for replacements and the anticipated growth in demand for veterinary services, when related to the limited number of veterinarians that can be trained each year by existing schools, point toward continued favorable opportunities for veterinarians in the long run. However, the demand for veterinary service is closely related to economic conditions, as the market value of an animal usually determines the professional care that can be afforded. Any major economic recession would greatly affect incomes and employment opportunities in large animal practice. Practice with pet animals and government employment are less likely to be influenced by economic changes.

Earnings and Working Conditions

Beginning veterinarians employed full time by the Federal Government in 1956 received $5,200 a year; after 6 months, they could usually qualify for positions paying $5,440 annually. Summer trainees in the U. S. Department of Agriculture were paid at the rate of $3,670 a year. Veterinarians commissioned as first lieutenants in the Army and Air Force received a base pay of over $3,000 a year plus allowances for quarters and subsistence. In 1954, veterinarians employed by local public health agencies were paid median salaries of over $5,200.

Veterinarians beginning practice can generally cover their expenses the first year and may often add to their earnings by working part time for government agencies. The average income above expenses in 1950–51 was about $7,400 for veterinarians in private practice, according to an American Veterinary Medical Association survey. Income from private practice varies according to length of time in practice, location, and type of practice. Veterinarians specializing in practice with pets in large cities or with thoroughbred horses and other purebred animals generally earn the highest incomes. Very successful practitioners sometimes earn $20,000 or more a year.

Many private practitioners treat their animal patients on the farm, in open fields, or in unheated buildings. They are sometimes exposed to danger of physical injury, disease, and infection. Working hours for those in private practice are likely to be irregular, and veterinarians in rural areas may have to spend much time in traveling long distances. Veterinarians can continue working well beyond the normal retirement age because of the many opportunities for part-time employment or practice.

Where To Go for More Information

Additional information on veterinary medicine as a career as well as a list of schools providing such training may be obtained from:

American Veterinary Medical Association,
600 South Michigan Ave., Chicago 5, Ill.

Information on opportunities for veterinarians in the U. S. Department of Agriculture is available from:

Agricultural Research Service, U. S. Department of Agriculture, Washington 25, D. C.

Osteopathic Physicians

(D. O. T. 0–39.96)

Nature of Work

Osteopathic physicians are members of a school of medicine which emphasizes manual manipulation but also uses surgery, drugs, and all other accepted methods of medical care. Most are "family doctors" who engage in general practice. These physicians usually have office hours, make house calls, and also treat patients in osteopathic hospitals. A few doctors of osteopathy are engaged primarily in research, teaching, or writing and editing scientific books and journals. A small but growing number specialize in 1 of the following 11 fields recognized by approved specialty examining boards: Internal medicine, neurology and psychiatry, ophthalmology and otorhinolaryngology, pediatrics, physical medicine and rehabilitation, dermatology and syphilology, ob-

stetrics and gynecology, pathology, proctology, radiology, and surgery.

Where Employed

Nearly all of the 12,500 osteopathic physicians professionally active in the United States in 1956 were in private practice. Less than 5 percent held full-time salaried positions, mainly in osteopathic hospitals and colleges. A few were employed by private industry or Government agencies.

Osteopathic physicians are located chiefly in those States which place little or no limitation on practice and also have osteopathic hospital facilities. In 1956, slightly over half of all osteopathic physicians were in the following 5 States: California, with more than 2,000; Michigan, Pennsylvania, and Missouri each with more than 1,000; and Ohio, with more than 700. In each of 26 States, however, there were fewer than 100 osteopathic physicians.

Training and Other Qualifications

A license to practice as an osteopathic physician is required in all States. However, the scope of practice allowed differs among the States. Many States and the District of Columbia issue licenses permitting osteopathic physicians to engage in all types of medical and surgical practice. Some States limit osteopathic practice, principally by imposing restrictions on the use of drugs or surgery by osteopathic physicians.

To obtain a license, a candidate must be a graduate of an approved school of osteopathy and pass a State board examination. In 19 States and the District of Columbia, passing an examination in the basic sciences is a prerequisite for admission to the professional examination. Some States also require a period of internship after graduation from osteopathic school. All States except Florida and Rhode Island will usually grant licenses without further examination to properly qualified osteopathic physicians already licensed by another State.

Three years of preosteopathic college work followed by 4 years of professional study in an osteopathic college are the minimum requirements for the degree of doctor of osteopathy (D. O). Preosteopathic education must include a specified number of credits in chemistry, physics, biology, and English. During the first 2 years of professional training, emphasis is on basic sciences such as anatomy, physiology, and pathology and on the principles of osteopathy; the last 2 years are largely devoted to work with patients in hospitals and clinics.

After graduation, almost all doctors of osteopathy serve a 12-month internship at 1 of the 87 osteopathic hospitals which the American Osteopathic Association has approved for intern training. Those who wish to become specialists must have at least 3 years of additional training followed by 2 years of supervised practice in the specialty.

Every year, more young people apply for admission to the 6 approved schools of osteopathy than can be accepted. In selecting students, consideration is given to grades in preprofessional education, desire to serve as an osteopathic physician rather than as a doctor trained in other schools of medicine, scores on medical aptitude tests, and the amount of preosteopathic college work completed (in 1955, 3 out of every 4 students accepted had bachelor's degrees). Considerable weight is also given to a favorable recommendation by an osteopathic physician familiar with the applicant's background.

Newly qualified doctors of osteopathy usually establish their own practice. A few work as assistants to experienced physicians or become associated with osteopathic hospitals. In view of the variation in State laws regulating the practice of osteopathy, careful study should be given to the professional and legal requirements of the State in which the osteopathic physician plans to practice. Also, the availability of osteopathic hospital and clinical facilities should be taken into account when choosing a location.

Employment Outlook

Opportunities for osteopathic physicians were excellent in 1956 in those parts of the country where osteopathy is a commonly accepted form of medical care. A strong demand existed for additional doctors of osteopathy in California, Pennsylvania, and a number of midwestern States. Also, there were growing opportunities in the Southwest and Northwest. Prospects for beginning a successful practice were generally considered to be best in rural areas, small towns, and city suburbs, where the young doctor of osteopathy could become known more easily than in the centers of large cities.

The profession of osteopathy will probably continue to expand during the late 1950's and throughout the 1960's. In recent years, growth has been slow but steady, the total number of professionally active osteopathic physicians rising from about 11,000 in 1950 to about 12,500 in 1956. Although approximately 450 doctors of osteopathy are graduated each year, many of these are needed to replace those lost to the profession through death or retirement. Growth is expected to continue at about the same rate as in the early fifties unless training facilities expand beyond the slight additions presently contemplated.

In the long run, opportunities for osteopathic physicians will probably continue to be good owing to the likelihood of increased public acceptance of osteopathy, liberalization of certain State licensing laws, and the establishment of additional osteopathic hospitals. In addition, the demand for all kinds of medical care—including the services of osteopathic physicians—will continue to grow owing to the increase in population, Government provisions of medical services for veterans and members of the Armed Forces, the development of prepayment plans for medical care and hospitalization, and the underlying trend toward higher standards of health care.

Women osteopathic physicians will continue to find good opportunities not only in private practice but also on faculties of osteopathic colleges and on the staffs of hospitals and clinics. Approximately 8 percent of all osteopathic physicians are women. Although men and women are equally eligible for admission to osteopathic colleges, the proportion of applications from women has been declining. In 1956, women students represented less than 3 percent of the total enrollment.

Earnings and Working Conditions

As in many of the other health professions, incomes usually rise markedly after the first years of practice. Earnings of individual doctors of osteopathy vary greatly with ability, experience, the income level of the community served, geographic location, and other factors. Surgeons and other specialists usually earn more than those in general practice.

Many osteopathic physicians work more than 50 and 60 hours a week. Those in general practice work longer and more irregular hours than surgeons and specialists.

Where To Go for More Information

Persons wishing to practice in a given State should find out about the requirements for licensure directly from the board of examiners of that State. A list of State boards, as well as general information on osteopathy as a career, may be obtained from:

American Osteopathic Association,
212 E. Ohio St., Chicago 11, Ill.

Dental Hygienists*

(D. O. T. 0–50.07)

Nature of Work

Dental hygienists, working under the direction of licensed dentists, clean and polish patients' teeth and give advice on proper diet and care of the teeth.

Dental hygienists who work for private dentists may also take and develop X-ray pictures of the teeth, mix filling compounds, and do miscellaneous clinical work, in addition to cleaning teeth and assisting the dentist in his work on the patient.

Dental hygienists who are employed by school systems usually go from school to school to examine the children's teeth periodically and to refer individuals to dentists. They may also give classroom instruction, sometimes with visual aids, on correct toothbrush technique and proper diet. Some school systems require dental hygienists to make home visits to explain to parents the importance of good dental care.

Dental hygienists employed in hospitals or public health clinics may be called upon to work with bed-patients, as well as with those who are able to move about. They may also assist in research projects and give lectures to dental students on various aspects of preventive dental health education.

*Prepared by the Women's Bureau, U. S. Department of Labor.

COURTESY OF U. S. PUBLIC HEALTH SERVICE

A dental hygienist cleans a child's teeth prior to thorough examination by the dentist.

Where Employed

An estimated 6,000 dental hygienists were employed in 1956, most of them in the eastern States. The majority of dental hygienists are women.

Most dental hygienists work in private dental offices; some work in hospital clinics and other health institutions; and some, in dental hygiene schools. A few work in industrial plants. An increasing number are being employed by public school systems.

Training and Other Qualifications

Training for work as a dental hygienist may be secured in 34 schools of dental hygiene located in 24 States. The Council on Dental Education of the American Dental Association had, by October 1956, accredited 31 of these schools; the remaining 3 were under consideration. Of these schools, 22 are associated with the dental programs of universities; the remaining 9 are parts of institutes, colleges, or universities that do not have dental schools.

A bachelor's degree with a major in dental hygiene may be earned by completing a 4-year course which includes 2 years of regular college training in addition to a 2-year dental hygiene course. By completing only this 2-year course, however, a student may obtain a certificate or diploma in dental hygiene. The 2 years of training in dental hygiene include instruction in the manual skills involved in the work, methods of teaching, and courses in anatomy, bacteriology, chemistry, nutrition, and X-ray. Special emphasis is placed upon the dental aspects of these subjects, and the student spends a substantial amount of time gaining clinical experience. Sufficient additional courses to meet the requirements for the bachelor's degree are provided in the 4-year course.

To be admitted to an approved school of dental hygiene, the student must have finished high school. However, more and more schools are giving admission preference to students with some college training. In 1956, three of the approved schools would accept only students who had completed 2 years or more of college. Almost one-third of the 1,100 freshmen admitted to approved schools in 1955–56 had 1 or more years of college training. For those who plan to work in the field of public health, the 4-year program is desirable.

The minimum age requirement for entrance varies among approved schools; some schools accept students 17 years of age and over; others accept only those who are 18 or over; still others set a minimum age of 21 years. Maximum age limits also vary, but most schools do not accept students over 35 years of age.

According to a recent survey, costs including tuition, supplies, and equipment fees in approved schools averaged $977 for the 2-year dental hygiene course. Approximately $644 of this amount was for tuition. The cost of the 4-year degree program would, of course, include tuition and fees for an additional 2 years.

In order to practice, dental hygienists must be licensed by the State Board of Dental Examiners in the State in which they wish to practice. Upon passing the licensing examination, the hygienist becomes a Registered Dental Hygienist (R. D. H.). Each State has its own statutory requirements, and only a few States offer reciprocity. Therefore, in order to relocate in another State, the dental hygienist usually must take the State examination in that State.

Opportunities for advancement are relatively limited for dental hygienists. Dentists in private practice usually do not employ more than one

dental hygienist, which limits opportunities for supervisory work. A few health departments and school systems employ supervisors in dental hygiene, but the top positions as directors of dental programs are usually held by dentists. With additional training, however, the dental hygienist may become a teacher in a school of dental hygiene.

Employment Outlook

Employment opportunities for dental hygienists were excellent in 1956. Although the number of graduates (902) from approved schools in 1956 was almost double the number in 1950, reports indicate that about twice as many could have been employed. Shortages were especially acute in Southern and Western States.

The demand for dental hygienists, which has been increasing steadily over the past several years, is expected to continue and expand over the remainder of the decade and well into the 1960's. Many openings are created each year by relatively high turnover among young women in the field who leave their jobs for marriage and family responsibilities. A recent survey showed that most of the students in dental hygiene schools graduate in their early twenties and that more than 5 percent of them are married before graduation. Growing emphasis on preventive health measures, including early and regular dental care and expanding dental programs in schools and in public health services, will create additional openings for the services of dental hygienists.

As a result of the expanding demand, mature persons who wish to return to the profession or who can secure adequate training can expect to find good opportunities for employment.

Earnings and Working Conditions

Salaries for dental hygienists depend upon the location of the job, the type of employer, and the education and experience of the hygienist. Yearly salaries for hygienists working full time during 1953 averaged $3,615. The averages varied from $3,230 for those working in the Northeast to $4,908 for those working in the West. Highest average earnings were reported by those working on a commission basis for private dentists. Beginning annual salaries in the Federal service in 1956 were $3,175, $3,415, and $3,679, depending upon the applicant's qualifications.

A 40-hour workweek is usual for hygienists, and working conditions are generally pleasant. Paid vacations of 2 weeks are customary, but longer vacations are given on some jobs.

Where To Go for More Information

Information on approved schools, training requirements, and job opportunities may be secured from the following organization:

American Dental Hygienists Association,
1735 Eye St., NW., Washington 6, D. C.

Information concerning licensing requirements can be obtained from the State Board of Dental Examiners in the State in which the dental hygienist wishes to practice.

Physical Therapists*

(D. O. T. 0–52.80)

Nature of Work

Physical therapists, under the general direction of physicians, assist patients with muscle, nerve, joint, or bone injuries or diseases in trying to recover use of the disabled parts of their bodies. The principal disorders treated are fractures, poliomyelitis, cerebral palsy, arthritis, and physical injuries or deformities. Patients are primarily those disabled in work, home, or highway accidents; children crippled by poliomyelitis or cerebral palsy; and war veterans.

Physical therapists treat patients by means of physical exercises; applications of massage, heat, light, water, or electricity; or by use of mechanical apparatus. The recording and charting of each patient's progress is an important part of the therapists' duties. They also give diagnostic muscle and nerve tests to obtain data useful in planning a treatment program as well as in making the changes needed as a result of progress and prognosis. They usually are the ones who teach patients needing braces and crutches how to use and care for them. They also show patients and their parents or other relatives how to continue treatments at home.

*Prepared by the Women's Bureau, U. S. Department of Labor.

COURTESY OF U. S. DEPARTMENT OF THE ARMY

Army physical therapist giving electrical stimulation to the paralyzed muscles of a soldier patient's leg.

In addition, physical therapists may be responsible for clinical instruction of physical therapy students, students of related professions, or nonprofessional personnel (such as ward aides, orderlies, and clerks, concerned with the care of patients. Since the therapists' work is integrated with that of other members of the rehabilitation team responsible for a patient's total care, they must attend conferences at which the progress of patients is considered. A rehabilitation team is directed by a physician and may include a teacher, nurse, medical and psychiatric social worker, occupational therapist, psychologist, speech therapist, recreational worker, and vocational counselor.

Although qualified therapists handle all types of patients, some specialize in working only with children, veterans, amputees, or victims of poliomyelitis, cerebral palsy, or arthritis.

Where Employed

An estimated 7,800 qualified physical therapists, of whom about 85 percent were women, were employed in 1956. They were working principally in metropolitan areas throughout the country, but the northeastern and western States had considerably more physical therapists in proportion to population than did the southern or central States.

About half of the qualified physical therapists work in hospitals, where they treat mainly patients recovering from surgery, fractures, or other injuries and disabilities. About half of these therapists are employed by private, nonprofit hospitals, and about one-fourth by hospitals of State or local governments. Almost all of the remainder work in hospitals operated by agencies of the Federal Government, principally the Veterans Administration, as well as the Armed Forces and the U. S. Public Health Service. Most hospitals with physical therapists are large general hospitals but some specialize in services for children or the chronically ill.

More than one-fourth of the physical therapists are employed by rehabilitation or treatment centers, schools or societies for handicapped children, and public-health agencies. Most of these organ-

izations provide regular treatment for chronic cases.

The remainder work mainly in doctors' offices or clinics, teach physical therapy, or are engaged in clinical or laboratory research in treatment procedures or in any of the basic sciences such as anatomy or physiology. A few physical therapists serve as administrators or coordinators of departmental programs in large facilities or as consultants in governmental or private agencies.

Training and Other Qualifications

In 1956, 37 approved schools, including the Army Medical Service program, offered training in physical therapy. The majority of approved schools were affiliated with large universities, often through their medical schools. The others were operated by hospitals, most of which had university affiliations. All of the approved schools offered training to college graduates and 31 granted a certificate in physical therapy to graduate students completing 12- to 16-month courses. Entrance requirements for admission to these courses varied somewhat among schools but generally included prior study of specific biological, physical, and social sciences. About three-fourths of the approved physical therapy schools also offer undergraduate programs leading to a college degree. The degree program generally is a 4-year course open to high school graduates of good standing. Some colleges, however, accept undergraduate college students who have completed 2 years of general college work, including a certain number of prerequisite science courses.

Annual tuition in physical therapy schools varies from a minimum of $75 in a State university (for State residents) to a maximum of $1,000 in a private university. In 1956, numerous scholarships were being offered to students in an effort to attract more trained personnel into the field. The National Foundation for Infantile Paralysis, principal source of scholarship funds, requires that its recipients work under a qualified physical therapist for a year following completion of training.

Graduation from an AMA-approved school of physical therapy is requisite for membership in the American Physical Therapy Association, for State licensure, and for voluntary registration with the American Registry of Physical Therapists. Many employers, particularly large hospitals and organizations, hire only those persons who meet the requirements of these organizations. Legal registration, for which therapists must satisfy certain educational and employment standards, is now required for practicing in 24 States, while licensure laws are being considered in many others.

With the increase of schools in this field, numerous teaching positions have become available for physical therapists. These positions are generally open to those who have secured a college degree and who have had general clinical experience, preferably for at least 3 years. Other advancement opportunities for physical therapists lie in supervisory and administrative positions, but these exist mainly in large hospitals and organizations and are very limited in small centers or offices.

Important characteristics needed by physical therapists are emotional stability, a moderate amount of manual dexterity, and a strong interest in humanitarian service. Since physical therapists must help patients and members of their family understand the treatments given and prepare them emotionally for changes that occur, a therapist must have patience, resourcefulness, and a sympathetic attitude toward patients. Good verbal expression in giving instructions to patients and relatives; ability to plan and organize time, material, and work output; and physical stamina are also needed.

Employment Outlook

The rising demand for physical therapists, which began during World War II, continued to be acute in 1956, when 5,800 job vacancies were reported. This need existed despite the fact that the number of graduates from approved schools had almost tripled, rising from 238 in 1941 to 650 in 1955. The greater number of hospital beds and the growing public interest in the rehabilitation of all physically handicapped persons, including the large number of World War II veterans, have

been responsible for increased staff requirements.

This need is expected to continue during the remainder of the decade and well into the 1960's, as a result of the expanding use of physical therapy in caring for the injured, diseased, and aged. Vocational rehabilitation and crippled-children programs, in which States are aided by Federal funds, will further bolster the demand. More physicians are also expected to recommend physical therapy for their patients, as techniques and equipment for treating many other diseases improve. In addition to these new positions, many hundreds of job openings will result from turnover in the field, since the vast majority of workers are young women who may be leaving their jobs for marriage or family responsibilities. It has been estimated that at least 3,000 new graduates will be needed each year, through the middle 1960's, for new positions and replacements.

Since the supply of graduates from approved physical therapy schools is expected to be insufficient to meet these needs, employment opportunities should continue to be excellent through the mid-1960's. Opportunities will be good not only for staff jobs but also for teachers in physical therapy schools and for those engaged in research programs.

Over the long run, employment for physical therapists is expected to continue to expand, as advances in medical knowledge increase the life span of all the population, including the physically handicapped.

Earnings

Starting salaries of new graduates in physical therapy averaged $3,600 in 1956, according to a survey of the American Physical Therapy Association. A median salary of $4,400 a year was reported for 3,300 physical therapists, about two-thirds of the Association membership. Some salaries were supplemented by maintenance and/or meals and by the laundering of uniforms. Entrance salaries for physical therapists in the Federal Civil Service (as set during the latter part of 1955) ranged from $3,670 to $5,440 a year, depending on the previous experience of the applicant. At the same time, a starting rate of $4,063 including rental and subsistence payments was paid to therapists (second lieutenants) in the Women's Army Medical Specialist Corps and also to junior assistants in the commissioned corps of the U. S. Public Health Service.

A salary survey of hospital personnel made by the Bureau of Labor Statistics in 15 metropolitan areas indicated that weekly salaries of physical therapists ranged from $65.00 to $87.00 in 1956 and early 1957. Average straight-time weekly earnings and average weekly hours of physical therapists in each of the survey areas are shown below:

City	Weekly average: Hours	Weekly average: Earnings
Baltimore	40.5	$77.00
Boston	40.0	65.00
Buffalo	40.0	71.50
Chicago	40.0	78.50
Cincinnati	40.0	81.50
Cleveland	40.0	74.50
Dallas	40.0	76.50
Los Angeles–Long Beach	40.0	82.00
Memphis	43.5	86.00
Minneapolis–St. Paul	40.0	87.00
New York	39.5	78.00
Philadelphia	39.0	69.00
Portland (Oreg.)	40.0	80.00
San Francisco–Oakland	40.0	83.50
St. Louis	41.0	77.50

Salaries of supervisors were reported by the APTA in 1955 to range from $5,000 to $6,000 a year. Administrators' salaries ranged upward from about $8,000 a year.

Where To Go for More Information

Additional information concerning women as physical therapists is available in a U. S. Department of Labor's Women's Bureau publication The Outlook for Women as Physical Therapists. Bulletin No. 203–1, Revised, 51 pp. Washington, D. C. 1952. Price 20 cents.

Information may also be obtained from:

American Physical Therapy Association,
1790 Broadway, New York 19, N. Y.

American Registry of Physical Therapists,
30 North Michigan Ave., Chicago 2, Ill.

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Medical Record Librarians*

(D. O. T. 0–23.25)

Nature of Work

Medical record librarians are responsible for keeping complete and accurate records of patients' illnesses and treatments. Primary use of the patients' records is made by physicians in studying patients' medical histories, diagnosing their ailments, and prescribing patient care. Medical records are useful to administrators in analyzing the health services offered by their organizations and in determining agency policies and procedures. The records are also used in training medical personnel and in developing and evaluating new treatments and medications.

The duties of medical record librarians include collecting and cataloging medical and surgical information such as reports on X-rays and operations, laboratory findings, doctors' orders, and progress notations; checking and organizing these data for completeness and accuracy; performing or supervising the coding and indexing of reports on various diseases and treatments; abstracting and transcribing case histories to permanent records; answering inquiries and preparing reports on individual cases; aiding in the development or improvement of procedures, forms, and methods; and preparing analyses for the use of physicians in their research work. (Medical record librarians should not be confused with medical librarians, who have charge of the library in a hospital or medical institution and who work with books and other publications. Medical librarians do not work with patients' records.)

In some hospitals, clinics, or other health organizations, two or more medical record librarians may be in charge of patients' records, but often one qualified medical record librarian, with the help of clerical assistants, has full responsibility for all the medical records of an organization.

The head medical record librarian may represent the department in hospital staff meetings and may have to vouch for the accuracy of records if they are subpenaed by the court. Because of the importance of the medical record department in many hospitals, the medical record librarian may participate in major decisions affecting the operating efficiency of the hospital.

*Prepared by the Women's Bureau, U. S. Department of Labor.

Where Employed

Over 6,900 persons were employed as medical record librarians in 1956. Almost all were working in hospitals. A few medical record librarians were employed in clinics, medical research centers, or medical departments of insurance companies and large industrial concerns. According to a survey made by the American Hospital Association in September 1955, almost two-thirds of their member hospitals were utilizing the services of medical record librarians. Almost nine-tenths of the persons in the occupation worked full time.

Since most hospitals are located in or near metropolitan areas, most medical record librarians work in the major population centers of the country. More than one-fourth are employed in the northeastern States.

Almost all medical record librarians are women, although men are beginning to enter the occupation. In 1956, 99 percent of the members of the American Association of Medical Record Librarians were women.

Training and Other Qualifications

Those seeking entry into this occupation today find formal training essential, even though less than 15 percent of the active medical record librarians in 1953 were graduates of the 30 schools affiliated with hospitals or universities and approved by the Council on Medical Education and Hospitals of the American Medical Association. In the past, training was conducted by hospitals themselves on an apprenticeship basis, but now most hospitals prefer to hire graduates of approved schools.

Seventeen of the approved schools offer a 12-month hospital course leading to a certificate in medical record library science. Prerequisite for enrollment in a certified course is 2 years of college or graduation from a recognized school of nursing. Six approved schools offer a 4-year degree course for high school graduates. Several have designed a 12-month certificate course for college graduates and 1 school has a 12-month degree course for those with 3 years of college. Courses in the approved

schools include at least 160 hours of anatomy, physiology, medical terminology, and fundamentals of medical science. In addition, all students are encouraged to become proficient in typing.

Tuition fees for certificate courses range from no fee in the one federally sponsored school to $425 in private schools. Tuition in degree-granting schools varies from $150 to $600 a year. Textbook expenses approximate $40.

In July 1956, there were 3,473 persons listed in a registry maintained by the American Association of Medical Record Librarians. About 35 percent of the medical record librarians employed on a full-time basis in hospitals were registered. Registration is considered to be a measure of professional attainment in this field, and many hospitals prefer to have at least one registered medical record librarian on their staff.

Requirements for registration are: Membership in the Association; either graduation from an approved school or the combination of sufficient education to qualify for admission to an approved school plus pertinent work experience during 5 of the 6 previous years; and passing a written examination.

Certain personal characteristics are required for successful and satisfying work in this occupation. Important among these are an interest in detail and a willingness to be thoroughly accurate. Since the medical information secured must be kept strictly confidential, medical record librarians must also be trustworthy. And in dealing with worried members of the patients' families, as well as with busy doctors, persons in this work must be tactful and courteous.

Assignments to supervisory work, primarily in large facilities, afford advancement opportunities for medical record librarians. In a large medical record department, the head medical record librarian may be responsible for the work of other medical record librarians and for a staff of typists, surgical secretaries, file clerks, and clerical workers.

Employment Outlook

The need for medical record librarians has been growing steadily since the start of World War II. As the number of hospitals and health facilities has increased and new methods of medical treatment have been developed, the recordkeeping function has become increasingly important. The training of qualified medical record librarians, however, has not kept pace with the demand. During the 1953–54 school year, student capacity of the approved schools was about 220, but enrollment was only about half that number. The American Association of Medical Record Librarians estimated that about 6,000 additional medical record librarians could have been advantageously used in hospitals in 1956. At the present level of school enrollment, the supply of qualified new workers will not be sufficient to meet the current demand or that anticipated well into the 1960's.

Over the long run, employment opportunities are expected to be good for graduates of approved schools. With the expansion of health facilities and services, additional new jobs for medical record librarians will be created. In addition, replacements will be needed for the young women in these jobs who will leave for marriage or family responsibilities.

Earnings

Starting salaries of registered medical record librarians averaged about $4,600 in 1956. In addition, many hospitals provided free medical care for their employees and some offered complete or partial maintenance. The basic salaries were related not only to the nature and responsibility of the position involved but also to the geographic location and size of the institution where the medical record librarians were employed. A medical record librarian in a small hospital, an assistant medical record librarian in a large hospital, or an inexperienced beginner often received less than $3,600. Salaries of medical record librarians entering the Federal Civil Service were set during the latter part of 1955 to range from $3,670 to $7,570 a year, depending upon the amount of previous experience.

Medical record librarians employed in hospitals located in 16 metropolitan areas were reported to receive average weekly salaries ranging from $68 to $86.50, according to a survey made by the Bureau of Labor Statistics in 1956 and early 1957. Average straight-time hours and earnings of medi-

cal record librarians in each of the surveyed areas follow:

City	Weekly average Hours	Weekly average Earnings
Atlanta	42	$75.00
Baltimore	40	76.00
Boston	40	68.00
Buffalo	40	76.50
Chicago	40	79.50
Cincinnati	40	83.50
Cleveland	40	84.00
Dallas	40	80.00
Los Angeles–Long Beach	40	86.50
Memphis	41	75.00
Minneapolis–St. Paul	40	81.50
New York	40	81.50
Philadelphia	40	70.00
Portland (Oreg.)	40	79.50
San Francisco–Oakland	40	$84.50
St. Louis	40	76.00

Where To Go for More Information

Additional information on employment conditions and opportunities for medical record librarians is given in the following publication:

U. S. Department of Health, Education, and Welfare, Public Health Service. Health Manpower Source Book, Sec. 6, Medical Record Librarians, 41 pp. Washington 25, D. C. 1954. Price 30 cents.

Information may also be obtained from:

American Association of Medical Record Librarians, 510 North Dearborn St., Chicago 10, Ill.

Occupational Therapists*

(D. O. T. 0–32.04)

Nature of Work

Occupational therapists organize educational, recreational, and prevocational programs which involve a variety of activities, to assist in the physical, psychological, and economic rehabilitation of injured and disabled persons.

After a physician makes his diagnosis and outlines treatment objectives for a patient, occupational therapists select and carry out a program of activities which will best meet the patient's needs. These activities may include typesetting, weaving, painting, clay modeling, leather craft, or photography. They may also involve training in adjustment to daily living through group planning and participation in dances, concerts, plays, and other activities.

Occupational therapists may supervise occupational therapy aides who teach a particular skill, volunteer workers, and student therapists. Some occupational therapists have administrative duties as directors and assistant directors of an occupational therapy program; some specialize in working with various disabled groups; others may serve as directors or teachers in approved schools of occupational therapy.

Where Employed

About 5,500 occupational therapists were registered with the American Occupational Therapy Association in January 1957. Most occupational therapists are women, but an increasing number of men are being trained for the occupation. Approximately 4 out of 5 occupational therapists work in hospitals and other health institutions,

COURTESY OF U. S. PUBLIC HEALTH SERVICE

Occupational therapist helping a patient to recover use of injured hand and arm.

*Prepared by the Women's Bureau, U. S. Department of Labor.

such as school clinics, sanatoriums, and some homes for the aged. Most of the remainder work in special workshops or rehabilitation centers to which patients come for treatment. These centers are sponsored by hospitals, religious organizations, or community agencies, such as associations for the blind, the deaf, or cerebral palsied. A few occupational therapists are employed in home visiting programs for patients unable to go to clinics or workshops.

Training and Other Qualifications

Graduation from an approved school of occupational therapy is a general requirement for occupational therapists. Graduates of schools accredited by the American Medical Association are eligible to take the national registration examination conducted by the American Occupational Therapy Association. Upon successful completion of the examination, they may use the initials O.T.R. (Occupational Therapist Registered) after their names. Hospitals of the Federal Government hire only registered occupational therapists.

In 1956, 30 colleges or universities offered courses in occupational therapy approved by the American Medical Association. For high school graduates, this training included 4 years of college work plus 9 months of supervised practice in hospitals and health agencies leading to a Bachelor of Science degree with a major in occupational therapy. The majority of these schools also accept college graduates who may earn a certificate in occupational therapy following 18 months of specialized training.

Occupational therapists without experience begin as staff therapists and may qualify as senior therapists after 2 years of experience on the job. Experienced therapists may become directors of therapy programs in large hospitals, clinics, or workshops, or teachers in occupational therapy schools. There are also some key positions as consultants with large institutions and agencies.

Personal characteristics needed in this occupation are emotional stability, a sincere interest in medical work, and a sympathetic but objective approach to illness and disability.

Employment Outlook

Opportunities for registered occupational therapists seeking employment are expected to be excellent well into the midsixties.

Since World War II, the demand for occupational therapists has been increasing. The growing public interest in the rehabilitation of all physically handicapped persons, including the large number of war veterans; the demonstrated success of occupational therapy programs in restoring persons to health; the help people receive from the occupational therapist in adjusting to their illness or disability and in increasing their usefulness to themselves, their families, and their communities—all these factors have been responsible for the rising demand for occupational therapists. Furthermore, increasing use is expected to be made of occupational therapists in treating illnesses and disabilities arising from industrial accidents, as well as in treating victims of cerebral palsy, poliomyelitis, and heart disease. Anticipated expanded use of occupational therapy in treating persons suffering from mental illnesses and in rehabilitating the growing number of aged persons will also increase the demand for therapists.

In addition to the new positions created by these developments, many job openings will result from turnover. In 1956, the number of jobs exceeded the number of trained workers. It is estimated by the American Occupational Therapy Association that 8,000 additional workers will be needed by 1958.

In order to meet the expanding demand, more students will have to enter training, and training facilities will have to be expanded. The present capacity of the approved occupational therapy schools is 3,500 students, although in the 1955–56 academic year only 2,600 were enrolled. Graduates in 1956 numbered 500. Even if schools were filled to capacity, the supply of graduates would be insufficient to meet the rising demand. Opportunities for men are especially good because of the demand for their services in mental hospitals, rehabilitation centers, and veterans' facilities.

In the long run, employment for occupational therapists is expected to continue to expand as public understanding increases with regard to the role which such therapy can play in facilitating the adjustments of disabled persons and patients with chronic illnesses.

Earnings and Working Conditions

Salaries of occupational therapists ranged from $3,500 to $9,000 in 1956 according to the American

Occupational Therapy Association. The beginning salary in the Federal Government in 1956 for occupational therapists without experience was $3,670 a year; and those with at least 1 year of experience started at $4,525. Many State institutions were offering $4,000 a year in 1956 for beginning therapists.

The 8-hour day, 40-hour week is customary, with only a few institutions working a 44- to 45-hour week. Vacation leave for therapists ranges from 2 to 4 weeks annually. Many positions now offer health and retirement benefits.

Where To Go for More Information

Additional information on occupational therapy is available in a U. S. Department of Labor's Women's Bureau publication The Outlook for Women as Occupational Therapists. Bulletin 203–2 Revised. Washington, D. C. 1952. Price 20 cents.

Detailed information on the field, on colleges offering approved programs, and on scholarships can be obtained from:

American Occupational Therapy Association,
250 West 57th St., New York 19, N. Y.

ENGINEERING

Introduction

Engineering is one of the largest professional occupations, exceeded in size only by teaching and nursing; for men, it is the largest profession. The approximately 700,000 engineers in the United States in 1956 contributed greatly to planning the work of, and designing the machines, equipment, roads, and buildings used by a majority of the Nation's 66 million employed workers. Engineers give technical and, frequently, managerial leadership in industry. They develop new products and processes, design many types of structures, devise the most efficient ways of obtaining minerals from the earth, and contribute in countless other ways to the technological progress of our civilization and to the national defense.

Nature of Work

Engineers are concerned with transforming natural resources into forms useful to mankind and with doing this in the most efficient manner possible. This emphasis on efficiency, which is related to cost, is one of the main factors distinguishing the work of most engineers from that of most scientists. A chemist may create a new compound or a geologist may discover an oilfield. It is the job of the engineer to figure out how the compound can be manufactured or the oil extracted at a cost low enough to be sold on the market. In constructing a large building, it might be possible to insure safety by making the walls of solid masonry 20 feet thick, but it is much more efficient and less expensive to have an engineer calculate just how much weight the walls will have to bear, what other forces will affect them, and what safety factors must be allowed. The engineer has to decide which building materials would be the best to use, considering the relative strengths and durability of the various materials, their cost, the quantities needed, and the cost of the labor required in construction. These same types of factors have to be considered by engineers developing and designing such diverse products as electronic equipment, home appliances, and diesel locomotives.

Besides developing and designing new and improved products, engineers perform various other types of work. Their "know-how" is used in administration and management, particularly in the industries in which engineering methods are most important. Many supervise construction or the operation of plants and mines. Others are engaged in research, aimed at providing the information needed in developing new products or methods of manufacture. Some, particularly trainees or beginning engineers, do drafting, analysis or testing, much of which is routine work. A sizable number work for consulting firms or as independent consultants, who advise their clients on engineering matters. Many companies employ engineers in selling their products, particularly when the salesman must be able to discuss the technical aspects of the product and assist in planning its installation and use. A relatively small but exceedingly important group of engineers teach in colleges, universities, or other engineering schools.

Most engineers specialize in some one branch of the profession, although there is a trend away from specialization in the early phases of training and career development. At least 20 specialties are recognized in practice and in engineering school courses. Several of these, which are discussed separately later in this chapter, are aeronautical, ceramic, chemical, civil, electrical, industrial, mechanical, metallurgical, and mining engineering. (Agricultural engineering is discussed separately under the chapter on Agricultural Occupations; see index for page number.) Work in each of these areas involves specialized knowledge, but there is a considerable body of basic knowledge and methodology which is common to most areas of engineering. Thus, engineers are often able to shift from one branch to another, particularly in the early stages of their careers.

Engineers frequently become specialists also in a particular technology or in the engineering problems of an industry. In many instances, these specialties cut across the traditional branches. Nuclear engineering is an example of a growing field of work associated with a new technology.

The engineer working in this field frequently has considerable academic training in physics and mathematics and often graduate training in nuclear engineering, but his bachelor's degree is usually in chemical, mechanical, or one of the other traditional branches of engineering.

Where Employed

The majority of engineers—about two-thirds of the total number in 1956—are employed in private industry. Virtually all manufacturing industries employ some engineers. The branches of manufacturing employing the largest numbers are the machinery, electrical equipment, and aircraft and parts industries. Other industries which employ sizable numbers of engineers include transportation and other public utilities, telecommunications, construction, and industries producing motor vehicles, chemicals and allied products, petroleum, fabricated metal products and ordnance, primary metals, and professional and scientific instruments.

Another large group of engineers—almost 20 percent in 1956—are employed by Federal, State, and local government agencies. Estimates of the proportions of engineers in still other types of employment are military (active duty), about 5 percent; self-employed (consulting firms), about the same proportion or slightly less; and educational institutions, about 2 percent. The remaining small group are in a variety of other fields, including commercial laboratories and nonprofit organizations.

Engineers are employed in every State, in small cities as well as large. The profession also offers opportunities for employment overseas. However, some branches of engineering are concentrated in particular industries or geographic locations (as indicated in the statements on the various branches later in this chapter).

Training and Other Qualifications

Four years of college work leading to a bachelor's degree in engineering is usually the minimum educational requirement for engineering work. Some engineers have, however, entered the profession with training in physics, one of the other natural sciences, or mathematics. Others have been able to enter the field without degrees but only after long experience in semiprofessional work and some college-level training. The proportion of engineers with advanced degrees is still small in most branches of the profession, but graduate training is being emphasized in the selection of personnel for an ever increasing number of jobs. Furthermore, training in some engineering specialties, such as nuclear engineering, is available chiefly at the graduate level.

It is important for prospective engineering students to select an accredited school of engineering, since persons trained at such schools generally have the best employment opportunities. Of the 215 universities and engineering schools which offered training in engineering leading to a bachelor's or a higher degree in 1956, 151 had curriculums which were accredited by the Engineers' Council for Professional Development.

In the typical 4-year engineering curriculum, the first year and part of the second are devoted to basic preengineering subjects such as mathematics, chemistry, and physics, and to courses in the liberal arts—the humanities, social sciences, and English. The last 2 years are devoted mostly to engineering and advanced mathematics and science subjects, with some differences in courses depending on the branch of engineering in which the student is specializing. Some institutions have 5-year programs, leading to the bachelor's degree and a number of engineering schools have arrangements with liberal arts colleges whereby a student spends 3 years in the liberal arts college and 2 years in the engineering school and receives bachelor's degrees from both. Thirty-five institutions have cooperative plans under which students spend alternate periods in attendance at college and in employment in industry or government. Under such plans, the normal 4-year curriculum is spread over 5 and sometimes 6 years, but the graduate has the advantage of about 2 years of industrial experience in addition to his engineering degree.

With the rapid developments in science and engineering, many employers in recent years have stressed the need for engineers with a strong background in mathematics and the basic sciences. Therefore, persons contemplating an engineering career should rate well above average in mathematics and science courses in high school and should continue to obtain extensive training in these subjects in college. There is also a demand for engineering graduates with broad training in other subjects, including the social sciences and the humanities. Furthermore, many employers

emphasize the extracurricular college record of prospective employees.

Beginning engineers may enter as trainees or in the more routine jobs. Many industrial employers have special training programs for their beginning engineers, designed to supplement college work with training in specific industrial techniques and to aid in determining the type of work for which the individual is best suited. With experience, engineers can move up to positions of greater responsibility. Those with ability and interest can advance to high-level technical, supervisory, and administrative jobs and even to top executive positions.

Laws providing for licensing or registration of professional engineers are in effect in all 48 States, the District of Columbia, and 5 Territories. In general, the purpose of the laws is to ensure that engineering work which may affect life, health, or property is done by registered engineers. The various laws have different provisions as to the types of work for which registration is required. For example, in one State only civil engineers have to register, although almost all other States provide registration for those in all major branches of engineering. In 1956, about 207,000 of the approximately 700,000 engineers in the country were registered.

Registration laws are subject to frequent change and improvement. Generally, requirements for registration as a professional engineer are: Graduation from an approved engineering college, plus 4 years of experience and passing of a State examination. Examining boards may accept a longer period of experience as a substitute for a college degree.

Employment Outlook

Employment opportunities for engineers were excellent in 1956. Demand for engineers increased rapidly after World War II—particularly after the outbreak of hostilities in Korea in 1950, when the needs of the expanded defense program were added to those of the growing civilian economy. The supply of new engineering graduates available during the early and middle 1950's was not enough to meet the rising demand. In 1956, about 26,000 bachelor's degrees in engineering were conferred, somewhat more than were granted in 1954 or 1955 (about 22,000 each year) but far less than the peak number of about 53,000 granted in 1950, when the largest number of veterans graduated. It should be noted, however, that in each year from 1954 to 1956 the number of degrees awarded was considerably greater than the largest number awarded in any year during, or prior to, World War II (about 16,000 in 1942).

Employment opportunities for women engineers, who still represent only a small proportion of the profession, were very favorable in 1956. Furthermore, there has been a recent trend for employers to eliminate salary and other employment differences between men and women engineers of comparable education and experience who are doing similar work.

The outlook is for continued expansion of the profession both in the next few years and over the long run. Engineering has been one of the most rapidly growing professional occupations in the United States in the past 50 years, and there is every indication that it will go on growing rapidly. Some of the major factors expected to raise the demand for engineering personnel are continued growth of population and expansion of industry, increasing complexity of industrial technology as, for example, the trend toward automation of industrial procedures, and further growth in expenditures for research and development. The large sums spent for research and development in recent years, by both industry and Government, have broadened existing areas of employment for engineers and opened up new ones, such as computer technology and nuclear energy. As scientific frontiers are further extended, additional areas of work for engineers will be provided. In addition, a rise in engineering enrollments is anticipated in colleges and universities, and this will result in many openings in teaching. (See statement on employment outlook in college and university teaching; refer to index for page number.) The demand for engineering teachers was already great in 1956, and most engineering colleges were having difficulty in recruiting faculty.

Besides engineers needed to fill new positions, thousands will have to be trained annually to replace those who die, retire, or transfer to other occupations. Losses to the profession from deaths and retirements alone were estimated to be about 10,000 a year in 1956 and were expected to rise slowly in the future.

Along with the expected growth in demand for engineers, an increase in the supply of graduates is anticipated. If the proportion of college grad-

uates majoring in engineering remains the same as in recent years, the number of bachelor's degrees conferred in engineering will rise slowly in the late 1950's and early 1960's and more rapidly thereafter. In 1965, the number may be as high as 56,000, more than double the number conferred in 1956, according to estimates by the U. S. Office of Education. Nevertheless, it is expected that employment prospects for engineering graduates will continue to be favorable through the early 1960's, at least.

This conclusion is based on the assumption that the Nation's economy will continue to expand. It also assumes that Government spending for defense, including research and development—a major factor affecting demand for engineers—will remain high. If Government spending for these purposes should drop, the demand for engineers would become less pressing. On the other hand, a substantial increase in defense expenditures or an acceleration in other Government programs such as public works would intensify the demand for engineering personnel.

For the student, the anticipated rapid growth in engineering enrollments may mean increasing difficulty in entering the engineering school of his choice. A number of land-grant colleges were already reporting crowded facilities in 1956. Unless facilities and teaching staffs are greately expanded, colleges and universities may not be able to accommodate all students wishing to enter engineering schools, and some institutions may raise entrance standards. In any case, the necessity for adequate preparation and realistic appraisal of aptitude for engineering work should be emphasized. In recent years, industry officials have continually stressed the need for high-quality men as a more pressing problem than inadequate numbers of graduates. Even under favorable employment conditions, the marginal student may not advance far up the professional ladder. On the other hand, there is every reason to believe that the demand for engineering graduates with ability and thorough training will remain high for many years to come.

The foregoing analysis relates to the outlook for the engineering profession as a whole. The differences among the various branches of engineering with respect to the current employment situation and expected future employment trends are discussed in the statements on these branches later in this chapter.

It will be noted that no evaluation of the future supply of personnel in each branch is included in these statements. Such evaluation is difficult for a number of reasons. In the first place, the numbers of students majoring in the various branches of engineering depend not only on the numbers of young people of college age and the degree of interest in the engineering profession but also on many special factors, such as the availability of training facilities and the relative employment situation in the various branches at the time the student decides to enter. Moreover, graduates with a degree in one field of engineering often find employment in another. This mobility of personnel is one of the reasons why differences in the employment situation among the various fields of engineering are likely to be moderate, at least among the younger members of the profession.

Earnings

Monthly starting salaries of new engineering graduates with bachelor's degrees and no experience are shown in the following tabulation, based on a survey made by Engineers Joint Council in the spring and summer of 1956.

Industry	Median (average) starting salary	Highest starting salary reported	Lowest starting salary reported
Chemicals and allied products	$410	$450	$375
Petroleum products and extraction	435	450	390
Primary metals, fabricated metal products and ordnance, and metal mining	405	490	375
Electrical equipment	425	500	375
Transportation equipment	425	500	350
Professional and scientific instruments	410	465	390
Other manufacturing and mining industries and construction	415	465	350
Railroads	410	425	365
Telecommunications	390	425	300
Utilities and sanitary services	400	435	325
Miscellaneous services:			
Consulting	425	500	300
Research and development	425	500	360
Government (other than Federal)	375	435	250

For engineering graduates with master's degrees, starting salaries were approximately $50 to $100 a month higher than for those with only bachelor's degrees. For graduates with doctor's degrees, monthly starting salaries typically ranged from $600 to $750. In early 1957, engi-

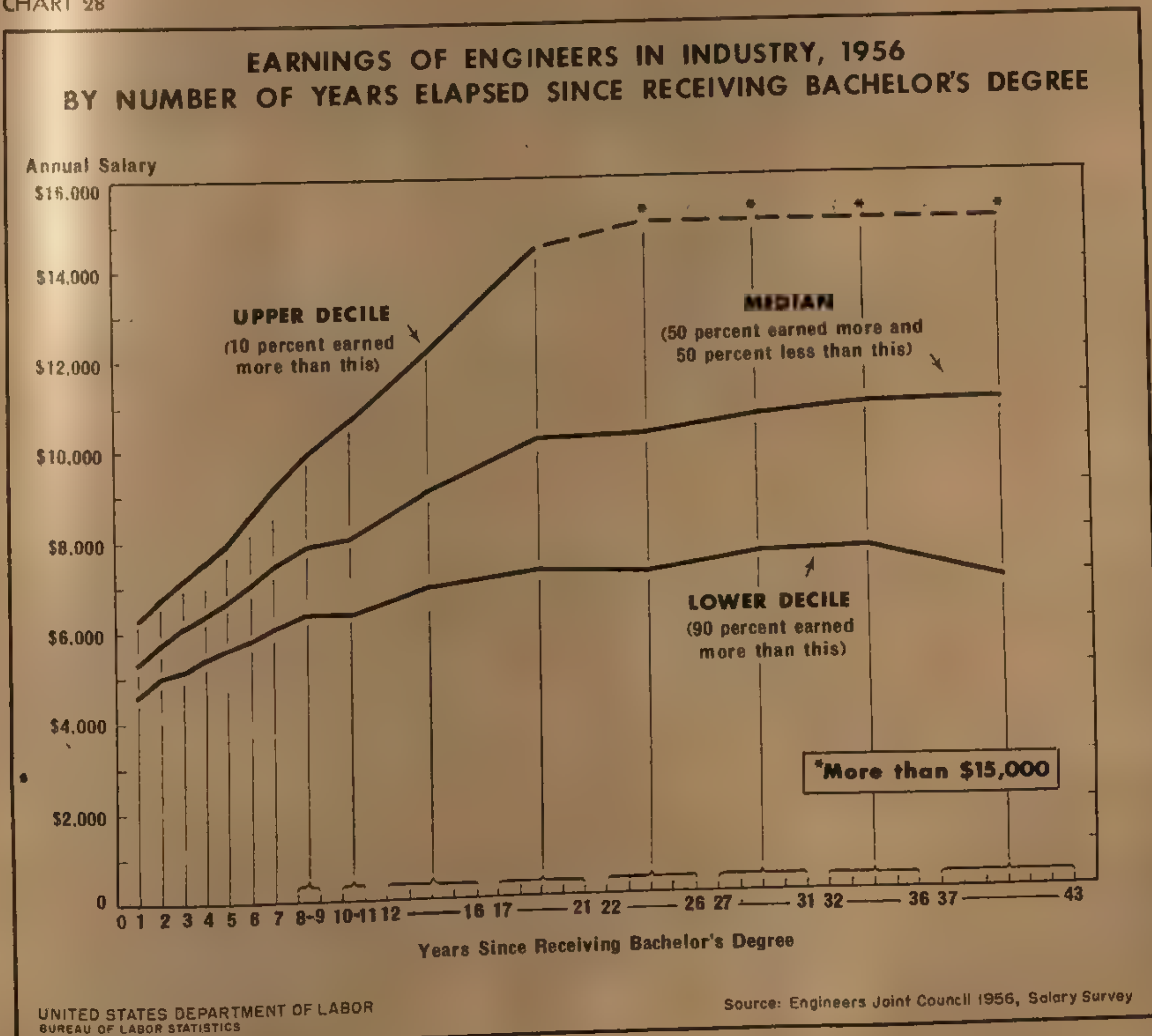
neering salaries were generally higher than in the spring and summer of 1956, when the data shown above were collected.

In the Federal Government, the beginning salary for engineers with the bachelor's degree and no experience was $4,480 a year in 1956. Those with the master's degree and no experience could begin at $5,335 a year, and those with the Ph. D. and no experience at $7,035.

Most engineers can look forward to a marked increase in earnings as they gain experience. Thus, the median (average) yearly salary of engineers with 10 years of experience was about $8,000 in 1956, and that of engineers with 25 years of experience was about $10,200 (chart 28). Ninety percent of the men in the latter group had earnings of at least $7,100 a year and 10 percent earned $15,000 or more. A few in top-level executive positions had much higher earnings than this.

In general, earnings of engineers are higher in private industry than in other types of employment. Though engineers in government employment generally make less than those in private industry, particularly in top-level jobs, their salaries tend to be higher than those of engineering educators. On the other hand, engineers in educational institutions can frequently supplement their salaries with income from special research projects, consulting work, publications, or employment during their vacations.

CHART 28



Where To Go for More Information

General information on engineering careers—including student selection and guidance, professional training and ethics, salaries and other economic aspects of engineering—may be obtained from:

Engineers Council for Professional Development,
29 West 39th St., New York 18, N. Y.

Engineers Joint Council,
29 West 39th St., New York 18, N. Y.

National Society for Professional Engineers,
2029 K St. NW., Washington, D. C.

Information on engineering schools and curriculums and on training and other qualifications needed for entrance into the profession may also be obtained from the Engineers Council for Professional Development, and information on registration of engineers, from the National Society of Professional Engineers.

Organizations which can furnish information on the respective branches of engineering are listed below:

American Ceramic Society,
4055 North High St., Columbus 14, Ohio

American Institute of Chemical Engineers,
25 West 45th St., New York 36, N. Y.

American Institute of Electrical Engineers,
33 West 39th St., New York 18, N. Y.

American Institute of Industrial Engineers,
145 North High St., Columbus 15, Ohio

American Institute of Mining, Metallurgical and Petroleum Engineers,
29 West 39th St., New York 18, N. Y.

American Society of Civil Engineers,
33 West 39th St., New York 18, N. Y.

The American Society of Mechanical Engineers,
29 West 39th St., New York 18, N. Y.

Institute of the Aeronautical Sciences, Inc.,
2 East 64th St., New York, N. Y.

The above list includes only some of the many engineering organizations. Other engineering organizations are listed in two publications available in most libraries: Engineering Societies Directory, 1956, published by Engineers Joint Council, and Scientific and Technical Societies of the United States and Canada, published by the National Academy of Sciences, National Research Council.

Some engineers are members of unions. Information on engineering unions may be obtained from:

The American Federation of Technical Engineers,
900 F St. NW., Washington 4, D. C.

Engineers and Scientists of America (Ind.),
Munsey Building, Washington 4, D. C.

See also statement on agricultural engineers (refer to index for page number).

The U. S. Civil Service Commission, Washington 25, D. C., will furnish information on positions available in Federal Government agencies. For further information, see chapter on Government Occupations.

Aeronautical Engineers

(D. O. T. 0–19.03)

Nature of Work

Aeronautical engineering is a relatively new and rapidly growing branch of the profession. Engineers in this branch work mainly on the design of the structure of aircraft. However, they are also concerned with all other phases of the planning, development, design, manufacture, and testing of aircraft and their parts and equipment.

Aeronautical engineers usually specialize in some area of work, such as structural design, aerodynamics, armament, electronics, propulsion systems, or production methods. Frequently, their specialization also extends to particular types of aircraft, such as commercial or military planes, rockets, or guided missiles.

Where Employed

Most aeronautical engineers are employed by aircraft and related industries. The largest numbers of these engineers are in the airframe industry but many are employed by propulsion unit (engine) and parts manufacturers. Some aeronautical engineers work for Federal Government agencies, principally the Department of Defense, the National Advisory Committee of Aeronautics, and the Civil Aeronautics Administration of the Department of Commerce. Small numbers work for commercial airlines, colleges and universities, and other types of employers.

Employment in this branch of the engineering profession is concentrated in the States where most

aircraft plants are located—chiefly California, Ohio, New York, Connecticut, Washington, Kansas, Texas, Maryland, Indiana, and New Jersey. (The geographic location of the airframe and engine and parts industries is discussed in more detail in the chapter on Aircraft Industry Occupations; see index for page number.)

Employment Outlook

Employment prospects for aeronautical engineers were excellent in 1956. In recent years, the demand for these engineers has been greater than the supply, largely as a result of the growing emphasis on airpower for national defense since the Korean emergency and the consequent enormous expansion of the aircraft industry.

The long-run outlook is for continued expansion of employment in this rapidly growing branch of engineering. Assuming that Government expenditures for aircraft, missiles, and related items continue to increase as expected, the aircraft industry will probably continue to grow. Moreover, the need for intensive research and development aimed at replacing obsolescent aircraft with improved types and the increasingly complex designs of airplanes and guided missiles, requiring more and more engineering time to design and build, are expected to increase further the demand for aeronautical engineers in future years.

Ceramic Engineers

(D. O. T. 0–15.11)

Nature of Work

Ceramic engineers are concerned with the processing of clay, silicates, and other nonmetallic minerals and with the manufacture of products from these raw materials; also with the construction and design of plant equipment and structures. Some are engaged in research and development work or administration and management. Others are employed in sales or teaching. A small number do consulting work.

Ceramic engineers usually specialize in one or more products—for example, refractories (fire- and heat-resistant materials, such as firebrick); whiteware (such as porcelain and china dinnerware or high voltage electrical insulators); structural materials (such as brick, tile, and terra cotta); glass; enameled metals; abrasives; cements, limes, and plasters; and many others.

Where Employed

Most men in this branch of engineering are employed in private industry. The largest numbers are in the stone, clay, and glass industries, but others work in the iron and steel, electrical machinery, chemical, and other industries which produce or use ceramic products. A small number work for government agencies, chiefly those of the Federal Government. Some are employed by educational institutions and by other organizations. A large proportion of all ceramic engineers are employed in the States of Ohio, Pennsylvania, New York, New Jersey, Illinois, and California.

Employment Outlook

Ceramic engineering is one of the smaller branches of the profession, and opportunities for new entrants in any 1 year are relatively few. Nevertheless, the demand for ceramic engineers has in recent years exceeded the supply, and employment opportunities have been excellent both for new graduates and for experienced men.

The long-run outlook is for continued growth of employment in ceramic engineering. Increasing use of glass, enameled metals, whitewares, abrasives, and other ceramic products will require research and design work to adapt these products to various needs. The increasing use of cement and structural clay products in construction will also add to the opportunities for ceramic engineers. Newer areas of work in nuclear energy, electronics, and jet and rocket propulsion will, likewise, provide additional opportunities for these engineers. For example, the development of ceramic coatings which are corrosion-resistant and capable of withstanding extremely high temperatures has played an important role in the development of jet engines. Problems posed by the development of aircraft capable of still higher speeds and greater altitudes will further increase the demand for ceramic engineers as well as for other engineers and scientists.

Chemical Engineers

(D. O. T. 0–15.01)

Nature of Work

Chemical engineers are concerned with the application of chemistry and other sciences such as physics and mathematics, and of engineering principles to manufacturing operations which involve chemical processes. They are responsible for the design, construction, and operation of equipment and plants and for other engineering work required in utilizing chemical processes on an industrial scale. Many of these processes have been separated into a series of "unit operations," such as mixing, crushing, grinding, crystallization, heat transfer, distillation, and drying. A large part of the chemical engineer's work involves the application of one or more of these "unit operations" to the manufacture of a product.

The chemical engineer may specialize in a particular type of operation (for example, heat transfer, distillation, or drying) or in the products of one industry (for example, petroleum, plastics, rubber, food, or industrial chemicals). The activities in which they are chiefly engaged are research and development, plant operation, design, and management.

Where Employed

A great many industries use chemical engineers. However, most are employed by manufacturing firms—chiefly in the chemical and petroleum industries. Some are employed in government agencies, in consulting firms, or as independent consulting engineers, and in college teaching.

Chemical engineers are employed to some extent in all States, mainly in or around large industrial areas. The largest numbers are in the States of New York, New Jersey, Pennsylvania, Ohio, California, Illinois, and Texas.

Employment Outlook

Employment opportunities for chemical engineers were excellent in 1956. In recent years, demand for these engineers has exceeded the supply—largely as a result of the rapid expansion of the industries in which most chemical engineers are employed (chiefly chemicals and petroleum) and of the tremendous growth of research and development in these industries.

The long-run outlook is for continued growth in this branch of engineering. Chemical engineering is one of the youngest of the major fields of engineering, and has grown rapidly in the past few decades. The major factors underlying this growth in past years will in all probability continue to be important in the future. In particular, the chemical and petroleum industries are expected to expand at a rate considerably faster than industry in general. In these and other industries employing chemical engineers, including atomic energy, continued expansion of research and development activity (in which about one-third of all chemical engineers are employed) is expected to accompany and contribute to industrial growth.

Civil Engineers

(D. O. T. 0–16.01)

Nature of Work

Civil enginering is the oldest branch of engineering. Historically, the profession had only two main branches, "military" and "civil." However, as technical knowledge expanded and industry became more complex, other fields of engineering developed. Today, civil engineers form 1 of the 2 largest of the many branches of the profession. They are concerned with the design and construction of roads, harbors, airfields, dams, tunnels, water-supply and sewerage systems, transportation facilities, buildings, and many other types of structures. The field is so broad that many specialties have developed within it—the major ones being structural, highway, hydraulic, railroad, sanitary, and public health engineering.

A sizable proportion of all civil engineers are in supervisory or administrative positions, ranging from that of site supervisor of a construction gang or head of a drafting department to top-level executive posts. Large groups are employed in design and related activities.

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Civil engineers are concerned with the design and construction of many types of structures.

Where Employed

About half of all civil engineers are employed by Federal, State, and local government agencies. The second largest group are in the construction industry. In addition, many are employed by consulting engineering firms or as independent consulting engineers. Others work for public utilities; for railroads; for banking, finance, insurance, and real estate firms (in such work as appraisal of properties); and in educational institutions. Still others are employed in the iron and steel industries and other branches of manufacturing.

Civil engineers work in all parts of the country, in every State and city. The largest numbers are located in or near the larger industrial and commercial centers. However, since civil engineers are frequently called upon to work at construction sites, they are sometimes stationed in remote areas of the United States or foreign countries. Furthermore, they are often required to move from one place to another to work on different jobs, although many civil engineering positions involve little or no travel.

Employment Outlook

Employment opportunities for civil engineers were very good in 1956. In recent years, civil engineers have not been in as short supply as members of some other branches of the profession, but many civil engineering positions have remained unfilled, particularly in State and local governments where salaries have been lower than in other areas of work.

The outlook is for continued growth of civil engineering. Construction activity, including not only housing and industrial building, but also water and sewerage systems, is expected to have an upward trend for many years as a result of population growth and the expansion of the Nation's economy. The enormous highway construction program voted by Congress in 1956 will create many new jobs for civil engineers during the coming decade. In addition, large numbers of civil engineers will be needed each year to replace those leaving the field. Civil engineers have a higher average age than members of any other branch of the profession, and consequently a higher rate of retirements and deaths. The number of civil engineers needed to replace men thus lost to the profession was estimated at approximately 2,800 a year in 1956 and will probably rise slowly in the future.

Electrical Engineers

(D. O. T. 0–17.01 and .02)

Nature of Work

Electrical engineers are concerned with the generation of electricity and its transmission and use. They design, develop, and supervise the manufacture of electrical and electronic equipment—including electric motors and generators; radio, television, radar, computers, and other electronic apparatus; and electrical appliances of all kinds. They also participate in the design and operation of facilities for generating and distributing electric power.

The major areas of work in this branch of engineering include electronics, electrical machinery

and equipment manufacturing, telephone and telegraph, power, illumination, and transportation. Electrical engineers usually specialize in 1 of these broad areas of work or even in a subdivision of some 1 area. Radio engineering, for example, is an electronics specialty although it has become recognized as a distinct branch of the profession.

A sizable proportion of all electrical engineers are engaged in design, development, and research. Another large group are employed in technical administration. Others are employed in manufacturing operations or in technical sales.

Where Employed

Electrical engineers are chiefly employed by electrical and electronic equipment manufacturers, by electric light and power companies, and by telephone and telegraph and radio and television broadcasting companies. However, many members of this profession are employed in other industries, and some are employed in government agencies, in consulting firms or as independent consulting engineers, and in college teaching.

Employment in this branch of the profession is concentrated to a considerable extent in the industrial centers where electrical and electronic equipment is manufactured. However, jobs with electric light and power companies, telephone companies, and radio and television stations are located in every State—in small towns as well as large cities.

Employment Outlook

Employment opportunities for electrical engineers were excellent in 1956. In recent years, the number of job openings has exceeded the number of electrical engineers available, and many employers have reported vacant positions which they have not been able to fill. Demand has been especially great for electrical engineers with Ph.D. degrees.

In the last few decades, electrical engineering has been among the most rapidly growing branches of the profession. Today, it is 1 of the 3 largest branches of engineering. Since the initiation of the defense program in mid–1950, the enormous military needs for new and improved types of electronic and electrical equipment have been a major factor in the expanding demand for electrical engineers. These defense needs, added to those of the expanding civilian economy, have resulted in marked growth in the electrical equipment industry. Defense requirements have contributed especially to the tremendous increase in spending for research and development in this industry and hence to the demand for electrical engineers in research activities. There has also been rapid growth in the electric utility and the telephone and telegraph industries—other large fields of employment for electrical engineers.

The long-run outlook is for further growth in this branch of the engineering profession. The growth of the electrical equipment, electric light and power, and telephone and telegraph industries has been very rapid in the last half century, and this growth is expected to continue at a rapid rate with the greater use of electrical and electronic equipment by the Armed Forces, by industry, and in homes. Moreover, newer areas of work such as atomic power generation, aviation electronics, guided missiles, computers, and automation will probably continue to require large numbers of electrical engineers as well as other engineers and scientists.

Besides those needed to fill new positions, a sizable number of electrical engineers will be required to replace personnel lost to the profession by retirement or death. The number needed to fill such vacancies was estimated to be approximately 1,900 a year in 1956 and will probably rise slowly in the future.

Industrial Engineers

(D. O. T. 0–18.01)

Nature of Work

Industrial engineers are concerned primarily with the efficient use of machines, materials, and personnel in manufacturing and other industries. They often specialize in such types of work as the planning of plant layout so that the work will flow efficiently from one step in the production process to the next, or the selection and design of machines and equipment to be used in manufacturing operations. Among their numerous other specialties are time, motion, and incentive studies;

production methods and standards; cost control and records; quality control; safety engineering; and industrial relations.

Where Employed

A large proportion of all industrial engineers are employed in manufacturing industries. Others work in the construction and extractive industries, for utilities, and for the Federal Government. A number are employed by banks, mail-order houses, life insurance companies, and other large business organizations to improve the efficiency of clerical and other operations.

Employment in this branch of the profession is concentrated in the highly industrialized areas of the East North Central States (particularly Illinois, Ohio, and Michigan), and the Middle Atlantic States (New York, Pennsylvania, and New Jersey). Opportunities also exist in the growing industrial centers of the southern and West Coast States.

Employment Outlook

Although employment opportunities for industrial engineers were good in 1956, in recent years, industrial engineers have not been in as short supply as members of some other branches of the profession. However, the demand for these engineers has exceeded the number available, largely as a result of the rapid growth of the Nation's industries during the postwar period and of the increasing complexity of industrial operations.

Growing recognition of the importance of scientific management and safety engineering and the role of industrial engineers in reducing costs and increasing productivity have also stimulated demand for personnel trained in this branch of engineering. These same factors will probably continue to operate in the future—leading to a further rise in employment of industrial engineers in the late 1950's and over the long run.

Mechanical Engineers

(D. O. T. 0–19.01, .05, .81, .91)

Nature of Work

Mechanical engineering is 1 of the 2 largest branches of the profession. If aeronautical and industrial engineering, which are offshoots of this branch, were included with it, mechanical engineering would represent by far the largest branch of the profession.

Mechanical engineers deal primarily with machines, power, and heat. They develop and design machines such as internal combustion engines, steam turbines, jet engines, and nuclear reactors, which produce power from fuels and other sources. They also develop a great variety of machines and devices which use power—refrigerating and air-conditioning equipment, elevators, machine tools, printing presses, steel-rolling mills, and many others. Mechanical engineers often supervise the installation, operation, and maintenance of industrial machinery. Since virtually all industries use machines and require power, the work of the mechanical engineer underlies all kinds of industrial operations.

Because the field of mechanical engineering is so broad, many specialized areas of work have developed within it. Among them are automotive engineering, marine engineering, railroad equipment, steam power and heating, ventilating and air conditioning, hydraulics or fluid mechanics, instrumentation, and machines for specialized industries, such as petroleum, rubber and plastics, and woodworking.

Where Employed

Mechanical engineers are employed in every major branch of manufacturing and in many nonmanufacturing industries. The largest numbers are, however, in the machinery, fabricated metal products, transportation equipment, iron and steel, and other metalworking industries. A number are employed in government agencies, educational institutions, and consulting engineering firms, or as independent consulting engineers.

Though mechanical engineers are to be found in all parts of the country, the large majority are in nine States: New York, California, Ohio, Michigan, Illinois, Pennsylvania, New Jersey, Massachusetts, and Texas.

Employment Outlook

Employment prospects for mechanical engineers were excellent in 1956. In recent years, the

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demand for personnel in this branch of engineering has been greater than the supply, and many employers have been unable to fill vacant positions.

Mechanical engineering has been among the most rapidly growing branches of engineering in recent decades, particularly since World War II. The tremendous growth of the metalworking industries, stimulated by the mobilization program undertaken in mid-1950 and the defense program of more recent years, has resulted in a constantly increasing demand for mechanical engineers. The rapid expansion of research and development activities in these industries has also added to the demand for mechanical engineers' services.

The long-run outlook is for further growth in this branch of the profession. The metalworking industries are expected to continue to expand. Moreover, newer areas of work, such as atomic energy, weapons development, and automatic assembly will probably provide additional openings for large numbers of mechanical engineers as well as for other engineers and scientists.

Besides those needed to fill new positions, sizable numbers of mechanical engineers are required each year to replace those who retire or die. Recent estimates placed this number at approximately 2,100 in 1956, and it will rise slowly in the future.

Metallurgical Engineers

(D. O. T. 0–14.01 and .20)

Nature of Work

Metallurgical engineers are concerned with the processing of metals and their conversion into needed products. These engineers usually work in 1 of 2 main branches of metallurgy. The first of these extractive metallurgy, deals with the extraction of metals from their ores—with refining and related processes. The other branch, physical metallurgy, is concerned with the content and structure of metals and their alloys and with methods of converting refined metals into final products having a specified strength and hardness or other desired properties.

Persons working in the field of metallurgy are sometimes referred to interchangeably as metallurgists or metallurgical engineers. However, those known as metallurgists are likely to be engaged in activities such as research and development or analysis and testing, whereas those with the title of metallurgical engineers are engaged mainly in directing the processing of ores.

Where Employed

Metallurgical engineers are employed chiefly in metalworking industries—above all in the iron and steel and nonferrous metals industries. The metal mining industry also employs substantial numbers. Small numbers hold positions in other industries, government agencies, consulting firms, research organizations, and educational institutions.

Most metallurgical engineers are in the large metal-fabricating centers of the country, mainly in the Middle Atlantic States (Pennsylvania, New York, and New Jersey) and in East North Central States (Ohio, Illinois, Michigan, and Indiana). Those employed in the mining industry are naturally located chiefly in metal mining regions.

Employment Outlook

Metallurgical engineering is one of the smaller branches of the profession. However, the demand for metallurgists and metallurgical engineers has in recent years greatly exceeded the supply, and employment opportunities have been excellent for both new graduates and experienced men.

The long-run outlook is for further growth in this branch of the profession. The metalworking industries are expected to continue to expand, and increasing numbers of metallurgical engineers will be needed to work on problems involved in the adaptation of metals and alloys to specific needs. The development of such items as supersonic aircraft, jet engines, and guided missiles, for example, has created numerous new problems for the metallurgical engineer. Also, the atomic energy program has opened the door to a whole new field in the study of metals and their uses. As the supply of high grade ores is depleted, problems involved in processing low-grade ores will further increase the need for metallurgical engineers.

Mining Engineers

(D. O. T. 0–20.01 and .11)

Nature of Work

Mining engineers are responsible for extracting minerals from the earth and for the preliminary processing of ore to remove rock or other unwanted materials. They plan and supervise the construction and operation of mines. This work involves the construction of mine shafts and tunnels, devising the means of extracting the minerals, and planning the methods to be used in transporting them to the surface. It may also involve the design and installation of water supplies, electric light and power facilities, and ventilation equipment. Mining engineers are responsible for mine safety. They often have to appraise the value of mines or mineral deposits. Frequently, they also direct any processing of minerals which is carried out at the mine site in order to remove rock, earth, or other substances with which the minerals are mixed. Another important function of mining engineers is exploration for ore-bearing rock or for deposits of petroleum, coal, or other minerals; in this work, they use a knowledge of geology, as well as engineering and other scientific techniques.

Mining engineers frequently specialize in a particular type of mineral—metals, petroleum and natural gas, coal, or nonmetallic minerals. They may also specialize in a particular type of work, such as mine safety, mine appraisal, or exploration.

Where Employed

Mining engineers are usually employed at the location of mineral deposits. For this reason, they often work in out-of-the-way places—in mountains or deserts. Those engaged in research, teaching, management, or consulting may, however, be located in large metropolitan areas. The majority are employed in Texas, California, Pennsylvania, Oklahoma, Louisiana, West Virginia, Illinois, Minnesota, New York, and Colorado.

Employment Outlook

Since mining engineering is one of the smaller branches of the profession, opportunities for new entrants in any 1 year are relatively few. Furthermore, employment prospects for new graduates with a degree in mining engineering were less favorable in 1956 than for those in most other branches of engineering. The best opportunities were in the exploration field—for graduates with considerable training in geology, geophysics, and other aspects of exploration technology.

Mining engineering is expected to grow over the long run, although more slowly than most other branches of the profession. As needs for metal increase with the expansion of industry, and easily mined deposits are exhausted, mining engineers will be needed to devise ways of mining poorer deposits or those which are more difficult to work at a competitive cost. Additional areas of employment for mining engineers will arise as the development of new alloys and the discovery of new uses for metals increase the demand for the less widely used ores. The expanding field of atomic energy, for example, has led to growing activity in the search for and development of uranium-bearing ores. In the petroleum industry, which has so far drawn chiefly upon the richer and more accessible oilfields, exploration crews including mining engineers with training in exploration technology will be needed to locate and exploit new oilfields, both in the United States and in other areas of the world.

PHYSICAL AND EARTH SCIENCES

Introduction

Natural science—the sum of man's knowledge of the physical world and of the animals and plants in it—had its beginnings many centuries ago. At first, scientific knowledge was so limited that men of science did not need to specialize. Aristotle, for example, was familiar with all the science known in his day and was the author of books on both physics and animal life. Gradually, however, the body of scientific knowledge became too great for one individual to grasp in its entirety, and scientists became specialists in different fields.

Today, the natural sciences are customarily grouped into several broad categories: physical sciences—chemistry, physics, astronomy, mathematics; earth sciences—geology, geophysics, geochemistry, meteorology; and life sciences—including agricultural, animal, and plant sciences and microbiology. Furthermore, most scientists now specialize in subdivisions of these broad fields. Physicists, for example, are usually specialists in such areas as nuclear physics or optics; chemists, in such branches as organic or inorganic chemistry.

The trend toward finer subdivision of the sciences has, in recent years, gone hand in hand with a blurring of the lines between the different specialties. Information and techniques developed by scientists working in one field have often, with some new discovery, become the basis for the solution of problems in a different field. New specialties, such as geophysics and biochemistry, have come into being through a combination of the knowledge of two or more sciences. Thus, the total body of scientific knowledge is interrelated in many ways. No one branch of the natural sciences is entirely independent of all others. This chapter is, however, concerned chiefly with the physical and earth sciences. The life sciences are discussed in the next chapter.

It would be hard to exaggerate the importance of the natural sciences to the country's economic welfare and to the national defense. Nevertheless, they are relatively small fields of employment. The total number of scientists, including life scientists, at all levels of professional training was roughly 250,000 in 1956, or less than 0.5 percent of the total labor force. Total employment in 1956 in the largest of the sciences—chemistry—was about 100,000.

Employment in the natural sciences has been increasing steadily. From 1930 to 1956, when the population as a whole increased by more than 30 percent, the number of scientists increased by more than 400 percent. A substantial part of this growth has occurred since the end of World War II.

The rapid growth in the demand for natural scientists is a reflection of scientific discoveries which have led to new and improved products and processes in a wide variety of industrial fields. Developments in recent years in aircraft, in television and radar, in atomic energy and associated technologies, and in a multitude of chemical products are among the best known examples, but they are only samples of a large number of uses of science in the production of necessities and conveniences for modern life. The sciences which have contributed most conspicuously to these developments are chemistry, physics, and mathematics. A number of life science specialties have also played important roles (as described in the chapter on Agricultural and Biological Sciences).

Some scientific specialties, such as astronomy and certain branches of mathematics, are still chiefly in the academic realm, with colleges and universities providing most of the employment opportunities. For many of the natural science professions, however, large fields of employment have opened up in the laboratories of business and government during the past four decades. After World War I, developments in the science of chemistry formed the basis of a rapid growth of the chemical industry, and a consequent great expansion in the chemical profession. Physics became industrially important during the 1920's and 1930's and has grown very rapidly since World War II. Mathematics has always been of fundamental importance to industry but its period of very rapid growth, the seeds of which were sown during World War II, began in the late 1940's and early 1950's. Although chemistry fathered a new industry, the impact of physics and mathematics

has not been predominant in any one industry but rather in a number of different manufacturing industries, notably electronics, professional and scientific instruments, and aircraft.

Generally speaking, scientific specialties which do not have large-scale industrial applications are very small fields of employment—affording opportunities chiefly in teaching for persons with advanced training. In order to offer sizable employment opportunities for persons with only 4 years of college training, a science must have developed a field of application—for example, in production or testing activities—where professional work can consist in applying established principles or already existing knowledge to the solution of practical problems, rather than in conducting research.

A long-run trend toward higher training requirements is apparent in all the natural sciences. There is a tendency to require more advanced degrees for many positions, especially in research, and there is also a growing need for more training in related sciences. The trend toward greater specialization and the blurring of the lines of demarcation between the traditional fields, mentioned earlier, have made it necessary for a scientist to know not only his own field but also those parts of other fields that are related to his work.

Future trends of employment in the sciences will be influenced by two main factors—the demand for college and university teachers, and the amount of expenditure for research and product development. College and university teaching is an important source of employment for scientists with graduate training, particularly those with Ph. D.'s. The expected expansion in college enrollments during the 1960's and beyond will undoubtedly result in an increased demand for qualified scientists as teachers. (See statement on college and university teachers, page 63.)

Expenditures for research and development are an even more important factor influencing the trend of employment in many fields of science. Funds for these purposes expended by the Federal Government, and by private industry and other sources, have grown greatly since World War II. The Federal Government, which has been the source of about half of these funds, increased its research and development spending about 500 percent between 1941 and 1953, primarily in connection with national defense. Total expenditures for research and development in 1953 were estimated at more than $5 billion, and have undoubtedly risen substantially since then. Expenditures for research and development by industry and government are expected to continue their expansion over the long run, and so should continue to support the upward trend in employment of scientists. However, materially reduced defense expenditures would slow down or halt, temporarily, the growth of scientific employment, as would any major decline in the general level of economic activity.

The employment outlook in the major branches of the physical and earth sciences—chemistry, geology, geophysics, mathematics, meteorology, and physics—is discussed in more detail in the following statements on each of these fields.

Chemists

(D. O. T. 0–07.02 through .85)

Nature of Work

Chemistry is by far the largest field of employment in the natural sciences. There were about 100,000 chemists in the country in 1956, about 6 to 8 percent of whom were women.

Chemists are concerned with the composition of substances, the physical and chemical changes they undergo; the way they react to each other; the chemical processes required to obtain them from nature or produce them synthetically; and the ways in which they can be put to practical use. In their jobs, chemists must often use mathematical and chemical formulas, make precise measurements, and work with complex laboratory apparatus.

Because of chemistry's vast scope, chemists usually specialize in 1 of the 5 main branches—organic, inorganic, physical, analytical chemistry, or biochemistry. Often, they may even specialize in a subdivision of one of these branches. Organic chemists, the largest group, usually deal with carbon compounds—substances chiefly derived from animal and vegetable matter. Inorganic chemists are chiefly concerned with compounds of other elements, including most of the minerals

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Chemists must often make precise measurements and work with complex laboratory apparatus.

and metals, but may also work with a few substances containing carbon such as carbonates and carbides, which are usually classified as inorganic. Physical chemists study the quantitative relationships between chemical and physical properties of both organic and inorganic substances—for example, how these substances are affected by electricity, pressure, heat, and light. Biochemists are concerned chiefly with chemical reactions occurring in plants and animals, such as the effects of food or chemicals on plant and animal tissues and with the influence of chemicals on life processes. Analytical chemists determine the exact chemical composition of substances and thereby provide controls for all types of chemical operations.

Some chemists specialize in a particular industry or product such as petroleum or plastics. In many instances, such work requires a knowledge of more than one branch of chemistry. The specialist in plastics, for example, may have to use physical as well as organic chemistry.

The largest number of chemists are engaged in research and development work. Most of these work on applied research projects aimed at creating new products or improving and finding new uses for existing ones. The others are engaged in basic research, designed to extend scientific knowledge rather than to solve any immediate practical problem. In addition, sizable numbers of chemists are engaged in technical administration, analysis and testing, and teaching. Smaller numbers are engaged in technical sales, production, technical service, consulting, and other activities such as patent work, technical writing, purchasing raw materials, and marketing research.

Where Employed

Most chemists—about two-thirds according to a 1955 survey by the American Chemical Society—are in private industry, primarily in manufacturing. The chemical industry employs the largest number, but manufacturers of such diverse products as petroleum, food, primary metals, electrical equipment, and rubber also use many chemists. The proportions of chemists in other fields of employment in 1955 were: 15 percent in teaching, 9 percent in government (mostly Federal), 5 percent in research institutes and consulting services, and the remaining small group in a variety of other fields of employment.

Some chemists are employed in every State. However, the greatest numbers are concentrated in the major metropolitan areas of New York, Pennsylvania, New Jersey, Illinois, Ohio, and California.

Training and Other Qualifications

A bachelor's degree with a major in chemistry is usually considered the minimum entrance requirement for beginning chemists, but graduate training is becoming a prerequisite for an ever-increasing number of jobs. More than 40 percent of the chemists answering the American Chemical Society's 1955 survey of its membership had Ph. D. degrees.

Chemists with the bachelor's or master's degree are most likely to find employment in manufacturing industries—particularly in industrial chemicals. Sizable numbers also find opportunities as research workers in government agencies, and many of those with master's degrees are employed as graduate assistants or instructors in colleges and universities while taking further graduate work.

In private industry, chemists with the bachelor's or master's degree usually begin as trainees in laboratory research or development work, in analysis, testing, quality control, technical service, or sales. With additional experience they may advance to positions of greater responsibility and eventually to management positions. Many industrial employers have special training programs for chemistry graduates. These programs are designed to supplement college training with specific industry techniques and to aid in determining the type of work best suited to the individual.

The doctorate is an extremely valuable asset in obtaining most types of employment in the chemical profession. It is considered to be particularly important for obtaining jobs in basic research and is essential for a career in college teaching. During the 7-year period from 1949 through 1955, more doctoral degrees were conferred in chemistry than in any other subject field. Those receiving the Ph.D. are most likely to enter research and development work or teaching. In fields such as biochemistry and physical chemistry, in which teaching and research positions are predominant, the doctorate is necessary for a high proportion of the jobs.

Employment Outlook

Employment opportunities for chemistry graduates were very good in 1956. The demand for chemists has increased rapidly since World War II, principally as a result of the rapid expansion of the chemical, petroleum, and other industries employing chemists and the enormous growth of research in these industries. Furthermore, the supply of new chemistry graduates was not sufficient during the early 1950's to meet the growing demand. About 6,800 bachelor's degrees in chemistry and biochemistry were conferred in 1956, slightly more than in 1954 and 1955, but far below the peak number of 10,794 granted in 1950, when many World War II veterans graduated. Moreover, not all graduates with a bachelor's degree in chemistry are available for work in the field. Many continue with graduate work before entering employment in chemistry. Others go on to studies in related fields such as medicine or leave chemistry for other reasons.

The long-run outlook is for continued expansion of employment in the profession. It is anticipated that the industries employing most chemists will grow at a rapid rate. In particular, the chemical and petroleum industries, which together employed about one-third of all chemists in 1954, are expected to expand considerably faster than industry in general. In these industries and many others, continued expansion of research and development activities (in which almost half of all chemists are employed) is expected to accompany and contribute to industrial growth. Not only is further expansion anticipated in the research organizations of large companies, but more and more small and medium-size companies are instituting or expanding research programs which will require the services of chemists. Furthermore, the enormous rise in enrollments anticipated in colleges and universities will result in many openings in teaching. (See statement on college and university teachers.)

In addition to those needed for expansion in employment, many chemists will have to be trained each year to replace those who die, retire, or transfer to other occupations. Losses to the profession from death and retirements were estimated to be approximately 1,200 in 1955 and will rise slowly in the future.

Along with the expected growth in demand for chemists, a steady increase in the number of chemistry graduates is expected. Assuming that the proportion of college graduates majoring in chemistry and biochemistry remains the same as in recent years, the number of bachelor's degrees conferred in these fields may be as high as 12,000 in 1965—approximately double the number conferred in 1955. The numbers of masters and Ph. D. degrees conferred each year are likely to rise correspondingly a few years later.

Even after allowance is made for the fact that not all chemistry graduates seek work in the field of chemistry, it appears that the number of new graduates at all degree levels available for work in the field could be about twice as great in 1965 as in 1955. Thus, there may be increased competition for the better paying professional entry positions in chemistry. However, the rising demand for chemistry graduates with ability and thorough training will continue to provide favorable opportunities for employment and advancement for such graduates for many years to come.

Employment opportunities for women chemists were favorable in 1956. Furthermore, there has

been a recent trend for employers to eliminate salary and other employment differences between men and women chemists of comparable education and experience who are doing similar work.

Earnings and Working Conditions

Chemistry graduates with a bachelor's degree and no experience had a median (average) starting salary of $400 per month, according to a 1956 survey conducted by the American Chemical Society. For graduates with a master's degree but no experience, the median starting salary was $443 and for those with the Ph. D., $600. Women graduates had a lower median salary than men—$375 compared with $407. Some graduates, of course, earned more and others less than these average figures. Ninety percent of those with bachelor degrees received more than $330 and 10 percent received more than $435. Starting salaries for 90 percent of the Ph. D.'s were more than $420 per month, and 10 percent of them received more than $639. The American Chemical Society survey also showed the following median monthly starting salaries for chemists in different fields of employment:

Type of employer	*Bachelor's degree*	*Doctor's degree*
Academic	(1)	433
Government	373	(1)
Contractor for Federal Government	400	(1)
Research institute	345	(1)
Industrial	410	610
Biological and pharmaceutical	345	(1)
Chemical	410	615
Machinery and equipment	410	(1)
Petroleum	427	600
Plastics	425	610
Rubber	410	(1)
Other	405	590

[1] Not available.

Some idea of the earnings of chemists with many years of experience can be obtained from a 1955 survey of American Chemical Society members. For example, the median monthly salary for male chemists with 24 years of experience was $779. Ninety percent of these experienced men reported earnings of at least $495 per month, and about 10 percent earned $1,434 per month or more. A few in top level executive positions had much higher earnings than this. The median monthly salary for women chemists with 24 years' experience was $489—much lower than the comparable figure for men. The difference in salary levels between men and women was greater among chemists with long experience than among those in beginning positions.

In general, a chemist's salary depends on the type of employer for whom he works, the kind of work he does, the extent and quality of his education, and the amount of his professional experience, as well as individual ability. Earnings of chemists are usually highest in private industry, as indicated by the information on starting salaries and also by other surveys. Government agencies generally pay less than private industry but more than educational institutions. A 1951 survey indicated that, in every age group over 30, the private industry employees with only the bachelor's degree had higher average incomes than Ph. D.'s in colleges and universities—suggesting that the type of employer for whom a chemist works is likely to have even more effect on his earnings than his degree. However, within a particular field of employment, Ph. D.'s usually earn considerably more than bachelors or masters with the same amount of experience. Furthermore, earnings levels are higher in some types of work than in others. For example, chemists in administration, technical sales, and industrial research tend to earn more than those in analysis and testing.

Where To Go for More Information

Information on schools, scholarships, earnings and other subjects may be obtained from:

American Chemical Society,
1155 16th St. NW., Washington 6, D. C.

Additional information on opportunities in the field of chemistry may also be obtained from:

Manufacturing Chemists Association, Inc.,
1625 Eye St. NW., Washington 6, D. C.

For additional sources of information, see also chemical engineers, industrial chemical industries, and petroleum industries.

Physicists

(D. O. T. 0–35.73)

Nature of Work

Physics is the science that deals with the physical or material universe in which we live. It is the science of matter and energy and of the way energy changes from one form to another. It is a mathematical science in that its most basic characteristic is the analysis and description of the physical universe in mathematical terms. Engineering and much of our modern technology are based upon the theoretical descriptions and analyses of physics.

The great majority of physicists are engaged in research or college teaching, and many do both. Research may be basic, directed to increasing knowledge without regard to practical application, or applied, directed to specific objectives. Some physicists contribute to the basic knowledge of their science primarily by making careful, systematic observations and performing experiments to identify and measure the elements of matter and energy and their interaction. Others contribute by seeking to connect such observations into a theory or system of equations describing the relations between them. Of course, experimental physicists are also concerned with theory, if only because they are testing it, and theoretical physicists help guide experiments. The difference is largely one of emphasis.

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Physicist observing the circular interference fringe from a mercury vapor lamp. Length measurements based on the interference pattern shown in the background can be made with an accuracy of 1 part in 100 million.

Applied physics, which probably occupies the majority of physicists, is primarily concerned with applying the results of basic research to the solution of practical problems and with the development of new devices for industry or for national defense. For example, physicists specializing in electronics, who study the emission, behavior, and effects of electrons, may be engaged in developing improved forms of such devices as vacuum tubes and electron-tube circuits for use in many types of equipment. Specialists in solid state physics are concerned, among other things, with the behavior of electrons, ions, and nuclei in solids. This work has led to the development of such items as transistors which have some of the characteristics of vacuum tubes and are being used in various types of communications equipment.

Modern physics includes such a large area of knowledge that most physicists specialize in one or more branches of the science—mechanics, heat, light, sound, electricity and magnetism, electronics, atomic and molecular phenomena, nuclear physics, classical theoretical physics, or quantum mechanics. This list of fields is neither final nor complete, however, since modern physics is changing and expanding in too many ways to be neatly arranged in compartments.

Where Employed

The total number of physicists in 1955 was estimated to be roughly 20,000. The largest number of physicists, probably about one-half, are employed by private industry. About one-third work for colleges and universities. The remainder are employed by the United States Government, and by foundations and other nonprofit organizations.

The most important industrial employers of physicists are the electrical equipment and aircraft manufacturers. Other industrial employers are the professional and scientific instrument industry, the chemicals and allied products industry and the petroleum industry. Most physicists em-

ployed by private industry work chiefly on research and development projects.

Most of the physicists employed by colleges and universities are engaged primarily in teaching, but many are engaged full time in contract research for Government or industry. A part of the U. S. Atomic Energy Commission's research, for example, is done by college laboratories under contract with the Commission.

Physicists working for the Federal Government are employed principally by the Department of Defense, the National Bureau of Standards and other parts of the Department of Commerce, the Department of the Interior, and the Atomic Energy Commission.

Training and Other Qualifications

Persons seeking careers as physicists must have at least a bachelor's degree with a major in physics to enter the field, and graduate training should be obtained if possible. Doctoral degrees are required for many positions, and are definitely preferred for many others. Of the approximately 10,000 physicists who were surveyed in 1954–55 by the American Institute of Physics, in cooperation with the National Register of Scientific and Technical Personnel, about half held Ph.D. degrees and about one-fourth held master's degrees.

One of the primary personal qualifications for physicists is a keen interest in finding out how things work. A talent and liking for mathematics is also required to accomplish anything of value in physics. The importance of mathematics is illustrated by Albert Einstein's definition of physics as "the sum total of our knowledge which is capable of being expressed in mathematical terms." As much mathematics as possible should be included in the studies of anyone interested in becoming a physicist; a serious deficiency in mathematics is difficult to overcome.

Graduate training is especially important for college teaching and research positions. Colleges and universities employ a majority of the holders of doctoral degrees and many of the holders of master's degrees, but only a small number of people who have not gone beyond the bachelor's degree. A majority of physicists with bachelor's degrees are employed in industry, usually in applied research and development rather than basic research. However, many companies prefer to hire personnel with Ph. D.'s, because their research problems are becoming so complex and advanced as to require the more complete training which the doctoral degree represents, and indications are that this situation will become more common.

The training in physics at the bachelor's degree level is not usually sufficient for the full development of a professional physicist, and many physicists with only a bachelor's degree do not work as physicists but turn to nontechnical fields of employment or to work as engineers.

Employment Outlook

The employment situation for physicists was excellent in 1956 and is likely to remain very good in the foreseeable future. In recent years, physics has been one of the fastest growing fields of science. It would have grown still faster, had it not been for the shortage of qualified personnel. In all probability, the demand for physicists will continue to mount for a long time.

The numbers of bachelor's degrees awarded in physics are also expected to increase—slowly during the late 1950's and early 1960's, and more rapidly thereafter, assuming that they follow the trends anticipated in college graduation as a whole. The numbers of students awarded graduate degrees may be expected to rise correspondingly a few years later. Altogether, very good employment opportunities for physics graduates are in prospect through the early 1960's, at least, and probably longer.

There are some differences in the outlook for holders of doctoral degrees on the one hand, and for holders of master's or bachelor's degrees on the other. Modern physics is becoming so broad and complex, and is expanding so rapidly, that the advanced training represented by the Ph. D. degree is becoming more and more important. As noted above, the training of a bachelor or master in physics is not usually sufficient to develop a fully professional physicist, and holders of these degrees are generally limited to applied research and development in areas where basic research has already supplied the fundamental knowledge required. In these circumstances, the doctoral degree will become increasingly necessary for employment, and particularly for advancement as a professional physicist, unless the bachelor's degree comes to represent more training in physics than it now does.

Persons qualified to do basic research or fairly advanced applied research and development have been and will probably continue to be in particular demand. Research organizations, whether those of government, universities, or industry, have had considerable difficulty in satisfying their requirements for physicists, and these requirements are expected to continue to increase.

The employment situation for physicists in college teaching was excellent in 1956 for qualified persons, and the demand will become greater as college enrollments increase. A shortage of teachers well qualified to teach at the graduate level will be one of the chief obstacles in any attempt to increase the supply of physicists.

The demand for physicists is largely dependent on expenditures for research and development. Total national expenditures for research and development, which have been increasing rapidly, particularly in the last 10 to 15 years, were estimated at more than $5 billion in 1953 and they have continued to increase since then. The continued growth of these expenditures has been largely responsible for the expanding demand for physicists.

In recent years, private industry and the Federal Government have been about equally important as sources of funds for research and development. If funds devoted to these purposes by Government and industry continue to increase, as they are likely to do, the demand for physicists will continue to expand. If the growth in research and development expenditures should slacken or even level off, the demand for physicists would become less pressing. Greatly increased research expenditures, such as would result from further mobilization, could only intensify the need for personnel.

Earnings and Working Conditions

The median (average) annual professional salary of physicists was about $7,275, according to a 1954–55 survey conducted by the American Institute of Physics. For physicists with Ph. D.'s, the median salary was about $7,850; for those without Ph.D.'s, about $6,600.

Salaries of physicists were materially higher in 1956 than in 1955. This upward trend in salaries is likely to continue.

There are some potentially hazardous elements in the working environment of many physicists, notably in nuclear and radiation physics. The precautions and safeguards used routinely in such work, however, hold the actual accident rates very low.

Where To Go for More Information

Additional information on the physics profession may be obtained from:

American Institute of Physics,
335 East 45th St., New York 17, N. Y.

Geologists

(D. O. T. 0–35.63)

Nature of Work

Geology is the largest field of employment in the earth sciences. There were about 13,000 to 15,000 geologists in the United States in 1956, representing approximately half of all earth scientists in the country.

Geologists are concerned with the study of rocks on and under the earth's surface, and with earth history as disclosed by rock formations and fossils. They search for minerals and fuels and study the physical processes by which changes in the earth's structure and surface features take place.

Most geologists spend a large part of their time in field work, usually in exploring areas to determine the underground structure of the earth and the kinds of minerals or rocks that may be discovered there. Field work may involve studying rock cores and cuttings brought up by drills, examining fossil remains of animal and vegetable life, recording data in notebooks or on working maps and aerial photographs, and collecting geological specimens. Geologists also spend considerable time in the laboratory, examining geological specimens and doing research. A large number perform administrative functions and, to an increasing extent, geologists are advancing to executive positions, especially in the petroleum and mining industries. In colleges and universities, geologists often combine teaching with research and administrative work.

COURTESY OF U. S. GEOLOGICAL SURVEY

Geologist examining rocks of the Cretaceous period in Alaska.

Geologists usually specialize in some branch of the science. *Economic geologists* are concerned with finding and developing mineral resources. *Petroleum geologists*, who locate and exploit petroleum and natural gas deposits, are also economic geologists but are generally regarded as a separate category of specialists because they constitute the large majority of all geologists. *Engineering geologists* are concerned with the application of geological knowledge to the solution of engineering problems as, for example, locating desirable sites for such structures as dam foundations. *Ground-water geologists* deal with the sources, quantity, and quality of ground water available for agricultural, industrial, and domestic use. *Paleontologists* are concerned with the identification and classification of the fossils of animals and plants from past geological periods. *Stratigraphers* study the arrangement and relationships of rock layers and their chronological succession. *Petrographers* study rocks, their origin, and composition. *Mineralogists* are concerned with the physical and chemical properties of minerals and the ways of classifying them and of distinguishing them from each other. *Geomorphologists* are concerned with the form of the earth's surface and with the forces—such as erosion, glaciation, and sedimentation—which cause changes in the landscape. *Structural geologists* study the structure of rocks and the physical processes which produced their structure.

Where Employed

Most geologists in this country—probably about 3 out of every 4—work for private industry. The great majority of these are in the petroleum and natural gas industry, which utilizes personnel in this profession chiefly in Texas, Louisiana, California, and Oklahoma, although it also employs some in nearly all other States and in foreign countries. In addition, some geologists are employed by mining and construction companies, railroads, public utilities, and manufacturing concerns—especially in the metal, stone, and clay products industries. A number of geologists work for consulting firms or as independent consultants; their services are utilized mainly by private companies interested in exploration for, and extraction of, minerals and fuels.

The remaining geologists in the country—roughly one-fourth of the total number—include a few on the staffs of museums and nonprofit research institutions, with the rest divided about equally between college and university positions and Government employment. Those in colleges and universities teach not only in departments of geology but also in mining, metallurgical, and civil engineering, and in other departments. The large majority of geologists in Federal Government positions work for the Geological Survey of the Department of the Interior. Other Federal agencies employing geologists are the Bureau of Reclamation, the Bureau of Land Management, and the Bureau of Mines of the Department of the Interior; the Atomic Energy Commission; the Corps of Engineers of the Department of the Army; the Soil Conservation Service of the Department of Agriculture; and the Federal Power Commission. State Government agencies also employ a number of geologists, many of whom work on State surveys conducted in cooperation with the Geological Survey. Most Government positions are located in continental United States, though some Federal jobs are in the Territories and possessions and in foreign countries.

Training and Other Qualifications

A bachelor's degree with a major in geology is usually considered the minimum entrance requirement for persons seeking careers as geologists, and graduate training is a prerequisite for an ever-increasing number of jobs. Some scientists, however, have entered the profession with training in petroleum and geological engineering or in related sciences.

Training in geology is offered by a sizable number of colleges, universities, and institutes of technology. In 1955, bachelor's degrees in the science were awarded by about 190 institutions, master's degrees by about 85, and Ph. D.'s by about 35.

Educational institutions have varying course requirements for the bachelor's degree, although certain basic subjects in geology must be taken by students majoring in the science. In general, the work in geology amounts to about one-fourth of the total semester hours during the 4 years of undergraduate study; usually about another fourth of the work is in related natural sciences and in mathematics; and the remaining half is in general studies, such as English composition, economics, and foreign languages. Some colleges provide a special program of studies leading to a bachelor's degree in geology that allows as much as half of the undergraduate course work to be taken in the major field. In some schools of engineering that offer undergraduate programs in petroleum engineering and petroleum geology, as much as 90 percent of the work may be taken in the major field and related subjects.

For entry positions in private industry, the bachelor's degree is often adequate preparation, especially when the applicant's scientific training has been thorough and has included extensive laboratory and summer field work. However, at least 1 year of experience in the field is commonly regarded as necessary before a beginning geologist with a bachelor's degree is placed in a professional position; many of the larger oil companies have formal training programs to acquaint beginners with their operations. A number of new graduates with bachelor's degrees in geology are employed by Government agencies. Some Federal agencies also appoint promising undergraduates to summer jobs; upon graduation, such students who meet qualifications may receive permanent positions with the agencies.

Postgraduate training is extremely helpful to geologists in competing for many professional positions. The Ph. D. degree is generally required for the more desirable college teaching positions and is also needed for many research posts.

The student who plans a career in geology should have an aptitude for science and mathematics. He should like outdoor activities and have considerable physical stamina, since geological field work frequently necessitates camping out, often under primitive conditions. A desire to travel is important, in view of the frequency with which geologists are required to move from place to place in the course of their employment.

Employment Outlook

Employment opportunities for geologists with master's and doctor's degrees were very good in 1956. Well-trained geologists with bachelor's degrees also had good job prospects, especially in exploration work for the oil industry.

The outlook is for continued growth of the profession both in the near future and over the long run. It is anticipated that the petroleum industry will expand in this country, and that a moderate increase will occur in employment of geologists for exploration activities in the United States. It is also expected that major oil companies will further extend their search for new oilfields in foreign lands, providing increased employment opportunities abroad for American geologists. The demand for geologists in exploration for minerals—including uranium and other ores used in atomic fission—and water will also increase. As the world's petroleum, mineral, and water resources diminish, it is becoming increasingly difficult to locate new sources of supplies. Thus, additional geologists with advanced training will be needed by industry to devise new techniques for exploring deeper within the earth's crust and to search underseas areas, as well as to do more extensive research and analysis of geological data. It is also expected that Government agencies will require larger staffs of geologists. For example, the Geological Survey, which has geologically mapped only part of the total area of the United States, will need more geologists for the large amount of work of this type that remains to be done. Furthermore, the number of students majoring in geology is expected to increase in the years ahead, along with college enrollments in

general. There will, therefore, be a significant number of openings for teachers of the science. (See index for page number of statement on college teachers.)

Besides geologists required to fill new positions, some will be needed to replace those who die or retire. However, losses to the profession from deaths and retirements will not be numerous in the near future, since geologists are a relatively young group.

Along with the expected growth in demand for geologists, an increase in the number of geology graduates is anticipated. In 1955, 2,456 degrees in geology were conferred—1,795 bachelor's, 507 master's, and 154 doctor's degrees. The total number was far smaller than the peak figure of 3,649 degrees awarded in 1950, the year when most World War II veterans graduated. However, the figure for 1955 represented a significant increase above that for 1954, which was only 2,180 degrees. The number of degrees in geology will probably continue to rise moderately in the late 1950's and increase more rapidly in the 1960's, assuming that the proportion of college graduates majoring in geology remains the same as in recent years. Nevertheless, prospects for geology graduates with ability and thorough training are expected to remain favorable through the early 1960's. On the other hand, new graduates with bachelor's degrees who have only minimal training may find it difficult to enter the profession, especially in view of the increasing amount of scientific knowledge required for geological activities. Such persons may be able to obtain only semiprofessional jobs in exploration activities and may find their opportunities for advancement severely limited.

Few women are currently employed as geologists. Their opportunities in field activities are and will continue to be limited, largely because of the rigorous nature of the work. However, some well-qualified women will be able to find positions as teachers in colleges and universities. Others, trained in certain specialties such as paleontology and petrography, will be able to obtain laboratory positions in industry and Government.

Earnings and Working Conditions

Recent information on earnings of geologists in private industry is limited to entrance salaries paid by several major oil companies. In 1956, these companies reported that monthly starting salaries for geologists with bachelor's degrees only were typically as follows: $425 for those without experience; $435 for those with some experience unrelated to geology; and $445 for those with some related experience. For geologists with master's degrees, typical salaries were reported to be as follows: $475 for those without experience; $485 for those with some unrelated experience; and $495 for those with some related experience. Geologists with Ph. D. degrees were reported to be earning $7,200 or more a year.

In the Federal Government service, the yearly starting salary for geologists with bachelor's degrees was $3,670 in 1956. Those with master's degrees could begin at $4,525; those with doctor's degrees, at $5,440. Many experienced geologists were receiving higher salaries. Those in supervisory and administrative positions were earning as much as $10,000 to $11,000 per year, and a few in high-level posts had even larger salaries.

Earnings of geologists are usually higher in private industry than in either Government agencies or educational institutions. Those in university positions, however, have the advantage of long summer vacations during which they can supplement their salaries by doing research, consulting, or other work. Extra allowances are generally paid geologists for work outside of continental United States.

Many geologists spend a great deal of time traveling, and may be away from home for extended periods of time. Their hours of work are uncertain, because their activities in the field are affected by weather conditions as well as by travel.

Where To Go for More Information

Information on the profession and the employment opportunities it offers may be obtained from:

American Geological Institute,
2101 Constitution Ave. NW., Washington 25, D. C.

The U. S. Civil Service Commission, Washington 25, D. C., will furnish general information on positions available in Federal Government agencies. For further information on such positions and how to apply for them, see chapter on Government Occupations.

Geophysicists

(D. O. T. 0–35.65)

Nature of Work

Geophysics is an overall term covering a number of sciences concerned with the physical aspects of our planet. Geophysicists deal with the measurement and utilization of the earth's forces—magnetic, electrical, gravitational, radioactive, seismic (the forces causing earthquakes), and geothermal (the forces resulting from the earth's interior heat and solar radiation). Some geophysicists study these forces from the standpoint of the physics of solid bodies (the solid earth); others from the standpoint of the physics of gases (the atmosphere); and still others from the standpoint of the physics of liquids (the oceans and other bodies of water).

Exploration geophysicists (sometimes known as prospecting geophysicists) are the largest group of geophysical scientists. They use the techniques of various geophysical specialties to search for sites where oil and minerals may be located. Most of them conduct or participate in field parties, which may also include economic geologists, petroleum engineers, and other workers. Those who act as party chiefs not only supervise the field work but are also responsible for the interpretation of the exploration data. In addition, some exploration geophysicists supervise petroleum and natural gas production operations, or conduct research on some phase of prospecting.

COURTESY OF U. S. GEOLOGICAL SURVEY

A field party using electromagnetic equipment to locate uranium deposits in the Colorado Plateau.

The second largest group of geophysical scientists are *hydrologists* who are concerned with the water supply of the land areas of the earth, both at the surface and underground. Some hydrologists work on such projects as water supply for particular cities, irrigation, flood control, and soil erosion. Others specialize in the control and removal of sediment which collects in river beds and harbors. Still others are concerned with glaciers, snow surveys, and the use of permanently frozen land areas.

The other smaller groups of geophysical scientists covered by this statement are oceanographers, seismologists, geodesists, volcanologists, specialists in terrestrial magnetism and electricity, and tectonophysicists. *Oceanographers* study the ocean in all its aspects, including its effect on the atmosphere, the sea bottom, and the shores. Those concerned with physical oceanography work on such projects as searching for petroleum deposits in tidewater and underseas areas, planning ways to prevent fouling of water in areas where oil is being drilled, and providing information needed in amphibious landings or the use of aircraft in rescuing men adrift at sea. Marine biologists, who study the fish and other animal and vegetable organisms which live in the sea, are sometimes classified as oceanographers although they are not geophysicists. *Seismologists* study earthquakes and the transmission of vibrations through the earth's interior. They provide information used in designing bridges and other buildings in earthquake regions, as well as in exploration for oil and minerals. *Geodesists* measure the size and shape of the earth, determine heights of mountains and hills, survey and map large areas of the earth's surface, and study the variations in the force of gravity in different parts of the earth. *Volcanologists* are concerned with the origin, location, and activity of volcanos, hot springs, and similar phenomena. *Geomagneticians* study magnetic and electrical processes in and about the earth, includ-

ing such phenomena as sunspots, the aurora, and the transmission of radio waves. *Tectonophysicists* are concerned with the structure of mountain ranges, continents, and ocean beds; the properties of natural materials forming the crust of the earth; the underlying strata in the earth's crust; and the physical forces that cause movements and changes in its crust.

Meteorology is another specialty which is frequently classified as a geophysical science. However, this specialty is discussed in a separate statement (immediately following this one), since it represents a separate field of training and employment.

Where Employed

It is difficult to estimate the number of geophysicists in the country. Only individuals employed in exploration generally use the title of geophysicist. In other geophysical activities, scientists usually have job titles which describe their specializations (for example, hydrologist, seismologist, geodesist) or their academic training (for example, physicist or engineer). The number of geophysicists in the country in 1956 has been variously estimated at from 7,000 to 10,000, depending largely on how many groups of scientists with titles other than that of geophysicist are included in the estimate.

Over half of all geophysicists work for private industry—chiefly for the petroleum industry. In addition, some are employed by exploration firms or in consulting services, and small numbers work for mining companies and in still other industries. Geophysicists in private industry are employed mainly in the southwestern and western sections of the United States, where most of the country's large oil fields are located, although many work in foreign countries where American firms are carrying on prospecting activities.

The second largest field of employment for geophysicists is the Federal Government. The Federal agencies employing most geophysical scientists are the Coast and Geodetic Survey, the Navy Hydrographic Office, the Geophysical Research Division of the Air Force's Cambridge Research Center, the Geological Survey, and the Atomic Energy Commission. In addition, a relatively small number of geophysical scientists are employed in colleges and universities, and still smaller numbers work for State Governments and for private research institutions.

Training and Other Qualifications

Geophysics is relatively new as a subject of organized instruction leading to degrees. Many students planning to enter geophysics still obtain their training in geology, physics, mathematics, or engineering, as did many present members of the profession. There is a gradual trend, however, toward the establishment of separate departments and curricula in geophysics.

Training leading to a bachelor's degree in geophysics may be obtained in only about 10 institutions. These undergraduate programs provide training chiefly in exploration geophysics, though the curricula may have other titles—such as geophysical technology or geophysical engineering. Some students take undergraduate training in exploration geophysics at colleges offering degree programs in engineering geology and petroleum geology. Other students prepare for exploration work by combining geology and physics in an undergraduate program.

To enter a geophysical specialty other than exploration geophysics, an applicant must, as a rule, have graduate training, although it is sometimes possible to qualify through extensive undergraduate work in science and mathematics plus on-the-job training. Graduate degrees are becoming increasingly important in competing for the more desirable positions. The doctor's degree is usually essential for teaching careers and is frequently required for positions involving fundamental research.

A student interested in obtaining a graduate degree in geophysics should locate a university or institute of technology which has an extensive program in geology, mathematics, physics, and engineering and offers opportunities to carry out research projects in the particular geophysical science in which he is interested. Such institutions are limited in number; in 1954, only 26 institutions awarded the master's degree and 10 institutions granted the doctor's degree in geophysics.

New graduates with bachelor's degrees who are hired for geophysical work in industry or Government are usually given on-the-job training in the application of geophysical principles to the projects of the particular employing agency. If the new employee's college work did not include

courses in geophysics, he is taught geophysical methods and techniques as part of his on-the-job training.

Some promising undergraduates have an opportunity for summer employment with Federal agencies. On these summer jobs, they receive practical training. Upon graduation from college, they may obtain permanent positions with the agencies. Similar opportunities are also provided by some exploration companies.

The prospective geophysicist needs an aptitude and interest in mathematics and physical sciences. He should have considerable physical stamina and should like to travel, since geophysicists often lead a rigorous outdoor life and explore remote areas of the earth.

Employment Outlook

Employment opportunities for geophysicists were excellent in 1956. Graduates with master's and doctor's degrees were especially sought by employers, and graduates with bachelor's degrees were also in demand.

The outlook is for continued growth of the profession both in the next few years and over the long run. As natural resources located at or close to the surface of the earth become depleted, more geophysicists will be needed to find new sites of fuel and minerals at greater depths underground and underwater, or under the shallow cover of extraneous material such as a heavy forest or sand and gravel deposits. The increasing complexity of exploration work and growing recognition of the importance of basic research in the geophysical sciences will add to the demand for geophysicists with advanced training to do research and to develop new geophysical techniques and instruments. The demand for geophysicists for research work will probably be stimulated also by the International Geophysical Year (1957–58). Scientists participating in this project—sponsored by more than 50 nations, including the United States—will study many aspects of man's physical environment. Their findings are expected to create increasing interest in geophysical research.

In all probability, the oil industry will continue to offer the largest number of employment opportunities for geophysical scientists. An increasing number of these scientists will most likely be assigned to exploration work in foreign countries, particularly in the Middle East, South America, North Africa, and Canada. In addition, mining companies are expected to employ growing numbers of geophysicists to find new mineral deposits. In Federal Government agencies, mounting civil and military demands will necessitate larger staffs of geophysicists to do such work as the mapping of land and water areas, investigation of water resources and flood control, research in radioactivity and cosmic and solar radiation, and exploration of the outer atmosphere for rocket flights. The anticipated rise in college enrollments, including students majoring in geophysics, will result in increased openings for teachers of the geophysical sciences. (See index for page number of statement on college teachers.) Furthermore, some geophysicist positions will become vacant as a result of deaths and retirements, although such openings will not be numerous in the near future since geophysicists are a relatively young group.

Along with the anticipated growth in demand for geophysicists, a rise in the number of geophysics graduates is likely to occur. In 1954, the last year for which information is available, only 328 degrees in geophysics were granted—206 bachelor's, 100 master's, and 22 doctor's degrees. Small as are these figures, the numbers of bachelor's and doctor's degrees were almost double, and the master's degrees were more than twice, those conferred in 1953. It is expected that the number of degrees in geophysical sciences will continue to rise in the late 1950's, and to increase more rapidly in the 1960's. However, the number of geophysics degrees awarded is a wholly inadequate measure of the supply of new scientists who enter the profession. In the past, the great majority of persons entering geophysics earned their degrees in other sciences. It is anticipated that the total supply of new scientists who become available for the profession will continue to be much greater than the number who earn degrees in geophysics.

Nevertheless, employment prospects are expected to be very good in this profession through the early 1960's, at least, particularly for persons with degrees in geophysics. Good employment opportunities are anticipated also for those who qualify through degrees in allied sciences.

Few women are employed at present as geophysicists. Their employment opportunities in field exploration are and will be limited because of the strenuous nature of the work. However, well-qualified women will be able to find positions

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in offices and laboratories, or as teachers in colleges and universities.

Earnings and Working Conditions

Detailed information on earnings of geophysicists is available only for Federal Government employees. In 1956, annual starting salaries in some Federal Government agencies were $4,480 for inexperienced geophysicists with bachelor's degrees; $5,335 for those with master's degrees; and $6,115 for those with Ph. D's. Many experienced geophysicists were receiving higher salaries. Those in supervisory and administrative positions were earning as much as $10,000 to $11,000 a year, and a few in high-level posts had even larger salaries.

Geophysicists working for private industry generally have higher earnings than do those employed by Government agencies and educational institutions. Teachers in universities, however, have the advantage of long summer vacations in which to supplement basic salaries by doing consulting, writing, and research work. Geophysical scientists working outside continental United States usually receive extra bonuses and allowances.

The duties of geophysicists, particularly in beginning jobs, often require prolonged absences from home. Work schedules are usually irregular and hours are frequently determined by travel, weather conditions, and the requirements of field activities.

Where To Go for More Information

Additional information on careers in geophysics may be obtained from:

American Geophysical Union,
1515 Massachusetts Ave. NW., Washington 5, D. C.

Society of Exploration Geophysicists,
Box 1536, Tulsa 1, Okla.

The U. S. Civil Service Commission, Washington 25, D. C., will furnish information on Federal Government positions in the geophysical sciences. For further information on such positions and how to apply for them, see chapter on Government Occupations.

Meteorologists

(D. O. T. 0–35.68)

Nature of Work

Meteorology is the science of the atmosphere. Its aim is complete understanding of the physical processes which produce "the weather." Weather forecasting and the collection and dissemination of weather data are the best known applications of meteorology. Meteorologists, however, are concerned also with a wide variety of other topics, ranging from the study of photochemical processes in the outer atmosphere to the effect of day-to-day changes in temperature on sales by retail stores.

Synoptic meteorologists make up the largest group in the profession. They interpret current weather data—air pressure, temperature, humidity, wind direction—reported by observers in many different places and make short- and long-range forecasts for given localities and regions. Other meteorologists are in several smaller branches of the profession. *Climatologists*, for example, investigate past records on wind, rainfall, sunlight, temperature, and humidity for a given area, and make analyses of probable weather conditions in the areas for some future time. *Dynamic meteorologists* study the physical laws of air movement. *Physical meteorologists* study the atmosphere's chemical composition and electrical properties; solar radiation; the transmission through the atmosphere of light, sound, and radio waves; and all the factors affecting clouds and rainfall. Scientists specializing in *applied meteorology* (sometimes called industrial meteorology) are concerned with the relationship between weather and human activities, biological processes, and industrial operations. For example, they make special forecasts for individual companies, conduct climatological studies for large-scale agricultural producers, induce rain or snow in a given area after determining optimum conditions for cloud seeding, and work on such problems as smoke control or air pollution.

Growing numbers of meterologists in both Government and private employment are engaged in research, ranging from daily practical problems to basic theory. The increasing use of the atmosphere as a medium of transportation and communication has focused attention on the meteor-

COURTESY OF U. S. WEATHER BUREAU

Briefing airline pilots on weather conditions along flight route.

ological aspects of rockets, guided missiles, earth satellites, radio propagation, cosmic rays, and auroral activity. In addition, research is being conducted on such subjects as long-range forecasting, radioactive "fallout," severe weather phenomena, weather control, aircraft icing, and solar heating.

Meteorologists who teach in universities or colleges may also do research or act as consultants. In colleges without separate departments of meteorology, they may teach subjects such as geography, mathematics, physics, and geology as well as meteorology.

Where Employed

In 1956, there were more than 6,000 meteorologists in the country. Of these, approximately 2,500 were on active duty as officers in the Air Force, and some were in the Army and Navy. In addition, the Air Force employed approximately 175 civilian meteorologists, and the Army and Navy together employed about 100. Meteorologists on active duty are usually engaged in weather forecasting for military operations, whereas most civilian meteorologists in the Armed Forces conduct research.

Approximately 2,250 meteorologists were working for the United States Weather Bureau, at 315 stations located in all parts of the continental United States, Alaska, the Arctic, Puerto Rico, Hawaii, Guam, and other places in the Pacific area. Other Government agencies, such as the Forest Service and the Soil Conservation Service of the Department of Agriculture, and the National Advisory Committee for Aeronautics of the Department of Defense, also employed some meteorologists.

Aside from Government, the main fields of employment for meteorologists are airlines, educational institutions, and weather consulting services. Approximately 250 meteorologists were working for commercial airlines in 1956—forecasting the weather along their companies' flight routes and briefing pilots on the weather conditions they might encounter. Colleges and universities with departments of meteorology employed 150 meteorologists, and other colleges without separate departments probably employed about an equal number. In 1956, 27 private weather services throughout the country employed 150 meteorologists to deal with their clients' special weather problems. In addition, a number of large companies in the aircraft, insurance, utilities, and other industries employ meteorologists on a full-time basis. Some meteorologists work for companies that design and manufacture meteorological instruments and balloons. Other meteorologists present weather programs for radio and television stations. A few are employed as editors and librarians.

A small number of women meteorologists are employed mainly as teachers in colleges and universities. A few work as forecasters for the Weather Bureau. Some women are on active military duty as meteorologists in the Air Force.

Training and Other Qualifications

Most meteorologists have at least a bachelor's degree, and many also have a master's degree or a doctorate. Though some have acquired their technical knowledge through many years of work experience, the attainment of professional status without completing college training is becoming more and more difficult, as the scope of meteorology widens through the increase in scientific knowledge and the development of new techniques.

In the Armed Forces, officers are sent to educational institutions for a year or more to train in meteorology and are then assigned to meteorological work. Ex-servicemen, with training and experience of this type, are given preference for civilian positions with the Armed Forces and can also qualify for positions with other employers of weather personnel.

For beginning positions with the Weather Bureau, the usual requirement is a bachelor's degree with a specified minimum number of hours' training in meteorology and related subjects. Other employers have similar requirements. The young person who wishes to become a meteorologist should plan, therefore, to complete a 4-year college program including courses in mathematics, physics, and meteorology. Bachelor's and graduate degrees in meteorology are granted by only about 17 universities, but many other universities offer courses in the subject.

Meteorologists with only bachelor's degrees qualify mainly for employment in synoptic meteorology. Graduate training is desirable for work in the other, more specialized branches of the profession, and for teaching and research.

The Weather Bureau has an in-service training program for its workers. Each year, scholarships are granted to Weather Bureau meteorologists, to enable them to take more advanced and specialized training. A student-aid program is also conducted by the Weather Bureau. Eligible high school graduates and college students preparing for a career in meteorology may obtain summer jobs with the agency until they receive degrees. They may then be employed as meteorologists.

Promotions in the Weather Bureau, as in other Federal Government agencies, are given according to Civil Service regulations. (See chapter on Government Occupations.) With the airlines, the chances for advancement are limited. However, some meteorologists in the largest companies may attain positions as supervisory meteorologists. Airline meteorologists are also able to qualify as dispatchers, after considerable work experience. Some well-trained meteorologists, with a background in science, engineering, and business administration, may find their best opportunities for advancement in the profession through the establishment of their own weather consulting services.

Among the personal characteristics needed by meteorologists are mathematical aptitude and an interest in physical science. Since most of the work is performed in an office, unusual physical stamina is not generally required. For some jobs, the ability to draw quickly and neatly is important.

Employment Outlook

In 1956, employment opportunities for meteorologists were very good. The Weather Bureau was seeking meteorologists, both new graduates and experienced men. Private companies also reported difficulty in recruiting these scientists, especially for research positions.

Additional meteorologists were needed by the Weather Bureau in 1956 not only to fill vacancies in weather forecasting positions but also to staff several new or expanded programs of hurricane research, air pollution research, storm warning, and flood forecasting which were authorized by Congress in 1955. The increase in demand for meteorologists resulting from these programs came at a time when the number of new graduates available for work in meteorology was declining. In 1955, only 60 bachelor's degrees in meteorology were granted—fewer than half the all-time record number (143) awarded in 1950, when most of the veterans graduated. Furthermore, graduates with majors in other fields, such as physics and mathematics, and some training in meteorology have been difficult to attract into weather forecasting or research, because of the many opportunities open to them in their major fields. Officers leaving the armed services have also gone, in most instances, into other fields of work, instead of seeking civilian positions in meteorology.

Employment of meteorologists in the Weather Bureau is expected to increase further until the end of the 1950's, at least, as a result of the research programs already authorized by Congress—although the exact size of the Bureau's staff, like that of all other Federal agencies, depends on the appropriations enacted each year. The Weather Bureau estimated in 1956 that it would need about 100 meteorologists yearly for the next 3 years, to fill new positions or replace workers who die, retire, or leave for other reasons. The Bureau also looks forward to continued growth of its research programs beyond this period, in view of the wide public interest in these projects. Further increase in the Bureau's forecasting staff is also anticipated over the long run because the continued expansion in civilian aviation will probably result in the building of new airports and weather stations.

Employment opportunities for meteorologists are also expected to increase in weather consulting services and on the staffs of private companies. More and more businessmen are utilizing weather and climatic data in planning their operations, and are turning to industrial meteorologists for assistance in solving their weather problems. As the value of this type of service receives further recognition, the demand for industrial meteorologists will continue to grow.

Opportunities for meteorologists with the airlines, however, will be limited. In 1956, these companies were seeking a few exceptionally qualified meteorologists with advanced scientific knowledge for research work on problems relating to the use of jet planes. In the normal airline positions connected with flight operations, occasional opportunities are expected as workers die, retire, or transfer to other positions. Future increases in the number of airline meteorologists are likely to be small. Although air traffic will no doubt continue to increase rapidly, the airline meteorologists who forecast weather conditions in given areas will generally be able to service the additional flights.

In colleges and universities, opportunities for meteorologists are expected to rise over the next decade, with the increase in college enrollment. The Armed Forces will also have some openings for civilian meteorologists.

Altogether, the outlook is favorable for future growth in meteorology. Since this is a small profession, the number of job openings arising in any one year will not be large. On the other hand, the numbers of graduates coming into the field will also be small in the near future (assuming that the proportion of college students majoring in meteorology remains about the same as in the past few years), and these graduates should have very good employment opportunities through the 1950's, at least.

Earnings and Working Conditions

Beginning meteorologists in Federal Government agencies were paid $4,480 a year in 1956. For the majority of experienced workers in Government positions, salaries ranged from $5,335 to $7,035 a year. Meteorologists in supervisory and administrative positions were earning as much as $10,000 to $11,000 a year, and a few in top-level posts had still higher salaries. Workers stationed outside the continental United States were paid an additional cost-of-living allowance. For personnel in Hawaii, this allowance amounted to 20 percent of the worker's basic salary; for those stationed elsewhere, it was 25 percent. The provisions for salary increase, paid vacations, sick leave, pensions, life insurance, and other benefits are the same for meteorologists as for all other Federal Civil Service employees. (See chapter on Government Occupations.)

Recent earnings data for meteorologists in private industry are available only for the airlines.

Most airlines divide their meteorologists into two classes with different salary scales. In 1956, class A meteorologists with airlines had a starting salary of $400 and a top salary of $695 a month—reached after 9 automatic yearly increases. In recent years, the airlines have had few, if any, class B meteorologists, who are inexperienced college graduates; after passing a company examination, such meteorologists are transferred to class A positions. The salary range for class B personnel was from $300 to $350 a month in 1956. Under the union contracts which cover most airline meteorologists, provision is made for raising salary scales when the cost of living rises. A few meteorologists in top supervisory positions with airlines earned between $10,000 and $12,000 a year in 1956.

Jobs in weather stations—which are operated on a 24-hour basis, 7 days a week—often involve nightwork and rotating shifts. Most stations are located at airports or other places in or near cities. However, some are in isolated and remote spots.

Where To Go for More Information

General information on the profession may be obtained from:

American Meteorological Society,
3 Joy St., Boston 8, Mass.

The United States Weather Bureau, Washington 25, D. C., will answer inquiries on employment opportunities with that agency, and will provide information on its student-aid program.

Mathematicians

(D. O. T. 0–35.76)

Nature of Work

There are three broad classes of mathematical work—pure or theoretical mathematics, applied mathematics, and mathematical computation.

Theoretical mathematicians are concerned with the logical development of mathematical systems and the study of relations among various mathematical forms. Their studies represent a form of logic dealing with methods of mathematical reasoning and analysis rather than with the uses or applications of these methods.

Applied mathematicians are concerned chiefly with analyzing the relations among the parts of a problem, and describing these relations in terms of a mathematical system. A mathematician of this type needs not only competence and imagination in mathematics, but also knowledge of the field such as physics or engineering in which he is working. Pure and applied mathematics are not always sharply separated in practice. Many important developments in theoretical mathematics have arisen directly from practical considerations. For example, the infinitesimal calculus was developed by Isaac Newton to deal with physical problems involving the velocity and acceleration of moving objects—phenomena which could not be described satisfactorily in earlier systems of mathematics.

The third broad type of mathematical work consists of using known mathematical formulas to obtain numerical answers to specific problems. Such work requires a high degree of skill in computation, but does not require the advanced training and inventiveness needed by the first two types of mathematicians. The great bulk of mathematical work done in scientific research and development, as well as in statistics and business, is of this type.

Where Employed

The total number of mathematicians in 1955 was roughly 20,000, of whom about 3,000 held Ph. D. degrees. Relatively few mathematicians are women—only about 9 percent, according to a 1954–55 survey of professional mathematical society members.

The largest number of mathematicians—more than two-fifths of the total in 1955—are employed by private industry. A somewhat smaller number work for educational institutions, chiefly colleges and universities. The rest are employed by Government agencies, chiefly the Department of Defense and the Department of Commerce, and by foundations and other nonprofit organizations.

The principal industrial employers of mathematicians are the aircraft and the electrical-equipment manufacturers. The primary metals, chemicals, and petroleum industries also employ

significant numbers of mathematicians. It is estimated that these five industries account for about a third of all mathematicians employed in industry.

Most of the mathematicians employed by industry hold bachelor's degrees only. A substantial majority of those holding Ph. D. degrees are employed by colleges and universities.

Training and Other Qualifications

A bachelor's degree with a major in mathematics is usually required for employment as a mathematician. However, a degree in some other subject with a strong minor in mathematics may be adequate for the less complicated beginning positions.

The training requirements for mathematicians for teaching and nonroutine research positions are often substantially higher. It is occasionally possible to enter these fields with the training represented by a bachelor's degree in mathematics, but a substantial number of positions require graduate training. The Ph. D. degree is required for many college and university teaching positions and for the more advanced research work. It is important for advancement, especially to the most desirable positions.

For teaching and for research in pure mathematics, training in nonmathematical subjects is not specifically necessary; but for teaching and research in applied mathematics, training in the field to which mathematics is to be applied is essential. For most applied mathematicians, the field of application is physics and related branches of engineering. Other fields of application are business and industrial management, economics, statistics, chemistry, and biology.

The development in recent years of high-speed electronic computers has brought a growing need for mathematicians particularly qualified to work with these machines. Knowledge of the methods of numerical analysis is especially important. Setting up the sequence or program for the machine to follow also calls for special training.

Employment Outlook

The employment situation for mathematicians in 1956 was very good at all levels of training, and excellent for holders of Ph. D. degrees. The situation will remain very favorable for the next 4 to 6 years at least, especially for applied mathematicians.

Employment of mathematicians as teachers in colleges and universities will increase substantially, both to take care of the much larger enrollments expected in the 1960's and to meet the growing need for more advanced mathematical training in many fields of study. The increased demand for college mathematics teachers will largely be a demand for Ph. D.'s, but there will continue to be many positions for holders of master's degrees. Colleges and universities will also continue to provide most of the employment opportunities for specialists in the relatively small field of theoretical mathematics.

Another factor which will tend to increase employment of mathematicians is the expected further growth in the demand for their services in scientific research and development. This demand is associated with the development of high-speed electronic computing machines which make possible more extensive use of mathematics than is practical with slower calculating equipment. It is chiefly a demand for applied mathematicians to work on physics and engineering problems.

In all probability, private industry and the Federal Government will continue to increase their expenditures for physics and engineering research and development, and thus raise the demand for mathematicians. If the growth in research expenditures should slacken, however, or increase more rapidly than now anticipated, the demand for mathematicians would change accordingly.

The new high-speed electronic computers are also opening up new fields of application for mathematics in business management. Large computers not only provide accounting and other data more rapidly, but also make possible analyses of business operations which were not practicable with less advanced equipment.

The broad new opportunities for applied mathematics which have been created by the great speed of the electronic computers insure a substantial and growing demand for mathematicians, but the amount of this demand, the lines along which it will develop, and the rapidity of the development cannot now be foreseen with any exactness. The demand generated by these computers—in scientific research and development, in business management, and in other areas—is a demand for employees who can apply mathematics to specific problems, not simply for mathematicians as such. Undoubtedly, a part of this demand will be satisfied by including more advanced mathematical

training in the education of engineers, biologists, and specialists in other fields to which mathematics is applied. Nevertheless, there will be a growing demand for applied mathematicians who combine a high degree of mathematical competence with a broad knowledge of the field of application. There will also be an expanding demand for people to do mathematical computation work. The long-run outlook is thus one of increasing demand, although the exact size and nature of the increase are not yet foreseeable.

The numbers of new college graduates with bachelor's degrees in mathematics will rise in the late 1950's and continue to grow, at an accelerating rate, during the 1960's, if graduations in this field follow the trends expected in college graduations as a whole. The numbers of mathematicians awarded graduate degrees tend to follow the trend in bachelor's degrees with a time lag of several years. However, employment opportunities for mathematicians are expected to remain very good through the early 1960's, at least, and probably longer.

Earnings

The median (average) annual salary of mathematicians was about $6,300 according to a 1954–55 survey of those belonging to professional societies. For mathematicians with Ph. D.'s, median salary was about $6,700; for those without Ph. D.'s, about $5,900.

Mathematicians in private industry tend to have higher incomes than those in other types of employment. In 1951, for example, the median annual professional income of mathematicians with Ph. D.'s was about 20 percent greater in private industry than in Government employment, and about 54 percent greater than in colleges and universities. Mathematicians without Ph. D.'s had a median 1951 income in private industry that was about 12 percent greater than in Government, and about 34 percent greater than in colleges and universities.

In the United States Government, the starting salary for mathematicians with Ph. D.'s but with no experience was $7,035 a year in 1956. The starting salary for mathematicians with bachelor's degrees only was $4,480.

Where To Go for More Information

American Mathematical Society,
190 Hope St., Providence, R. I.

Mathematical Association of America,
University of Buffalo, Buffalo 14, N. Y.

BIOLOGICAL SCIENCES

Introduction

The biological sciences are concerned with the structure of living organisms, and with such processes as birth, growth, death, and heredity. They cover the entire range of life, from the largest animals and plants to creatures too tiny to be seen without the aid of powerful microscopes and too elementary to be called either plant or animal.

Some biological scientists are concerned with basic research, aimed at increasing our knowledge of living things and of the relations existing among them, regardless of whether such knowledge is of immediate practical use. Others are concerned with the application of biological knowledge and research methods to practical problems in agriculture, forestry, medicine, and other fields. This chapter is concerned with the biological sciences as research and teaching fields. The large applied biological science fields are discussed elsewhere in the Handbook. (For statements on agricultural research workers, dentists, foresters, nutritionists, physicians, and veterinarians, see index.)

Nature of Work

The work of biological scientists lends itself more readily to detailed specialization than does that of most other scientists. It is very difficult to classify and define clearly and without overlapping each of the many areas of interest in which individuals are working, and there is disagreement as to the best general system of classification. Three of the ways in which the work of biological scientists can be classified are according to the different kinds of living organisms studied, the different points of view from which they can be studied, and the different methods of study which can be used.

When the biological scientists are classified according to the types of organisms studied, they fall into 2 or 3 main groups. One group is concerned with the study of animal life and another with the study of plant life. A third group—microbiologists, who study very small organisms—is often considered to represent another major division of the biological sciences.

Each of these broad groups can be divided further. Examples of the fields in which animal scientists specialize are: *entomology*, the study of insects and similar forms of life; *parasitology*, the study of animal parasites that live on or within man or other animal life; *ichthyology*, the study of fish and fishlike forms; *mammalogy*, the study of mammals; and *herpetology*, the study of reptiles and amphibians.

The plant sciences also have a number of subdivisions. Some of them are: *mycology*, the study of fungi; *algology*, the study of algae; *silviculture*, the study of trees; and *horticulture*, the study of the production and breeding of all types of food and ornamental plants except field crops.

The field of microbiology is regarded as a distinct category by a number of authorities, although others have classified it as a subfield of plant science. It is concerned with the study of micro-organisms, including bacteria, and their effects on plants, animals, other micro-organisms, and dead organic material.

Biological scientists also specialize in studying living organisms from different points of view. For example, a type of organism can be studied from the point of view of *evolution*, the way organisms have developed to their present forms; or of *systematics and taxonomy*, concerned with the identification and classification of organisms; or of *genetics*, concerned with what characteristics are inherited and with the mechanism of heredity. Some other points of view are *composition and organization*, concerned with the structure of whole organisms or systems of organs; *function*, concerned with the processes by which organisms move, eat, and otherwise function as living systems; and *ecology*, concerned with the relation between organisms and their environment.

A third way to look at the work of biological scientists is according to the methods used in studying biological problems. Among the most important methods are those of mathematics, chemistry, physics, physiology (the study of biological mechanisms and processes), morphology (concerned with physical structure), and field ob-

servation. The use of these methods in the biological sciences has led to the development of specialties such as biochemistry, biophysics, and biometrics which lie on the border between the biological sciences and other fields.

Taken together, these three systems of classifying the interests and activities of biological scientists show the range and diversity of these sciences, arising naturally from the amazing variety and complexity of living things. A description of the work of a biological scientist requires all three systems of classification. One interested in heredity may, for example, employ the methods of chemistry and use mice as the particular organism studied. Another scientist with the same central interest and working on the same kind of animal may make considerable use of mathematical methods. A particular research project may be concerned with several types of organisms which can be profitably studied from several points of view at the same time, employing more than one method of study and analysis.

This chapter is organized into separate sections on the animal, plant, and microbiological sciences. References are made within the sections to the larger and more important fields of specialization which often are not concerned with a specific class of organism but deal rather with broader problems.

Where Employed

The total number of biological scientists in 1956, including agricultural research workers of comparable training, was estimated to be more than 50,000. About 15,000 to 16,000 of these scientists held the doctor's degree.

Women represent a larger proportion of the personnel in some branches of the biological sciences than in other natural science fields. They constitute more than 10 percent of all biological scientists taken as a group and over 20 percent of the microbiologists.

The largest group of biological scientists are those who teach in colleges and universities, where a majority combine research with their teaching duties. A 1954–55 survey of about 15,000 biological scientists and agricultural research workers, all of whom had graduate degrees or bachelor's degrees and 4 years of experience, found that the majority of the scientists surveyed—51 percent—were employed in colleges, universities, and other educational institutions. The second largest number, 28 percent, worked for governmental agencies, and the smallest, 21 percent, worked in private industry. A majority of all biological scientists employed by governmental agencies worked for the Federal Government; others worked for State and local government agencies. The most important industrial employers were the chemical, food, and paper industries.

The relative importance of educational institutions, government agencies, and private industry as sources of employment for different groups of biological scientists is indicated in the sections that follow. The employment pattern described above refers to the biological sciences as a whole.

Training and Other Qualifications

A bachelor's degree with a major in one of the biological sciences is the minimum requirement for employment in these professions, and more advanced training is required for many positions. Most of the biological sciences offer opportunities for persons with bachelor's degrees to work as technicians or junior research workers. The range of positions for which the bachelor's degree is adequate preparation is wider in certain specialties in the animal sciences (particularly entomology) and in some aspects of microbiology than in other biological sciences, but more advanced academic training is very advantageous for advancement and for the more desirable beginning positions even in these fields. In general, however, the bachelor's degree is sufficient for jobs involving production and operations work, inspection and testing, technical sales and service, and routine applied research.

The master's degree usually indicates more intensive training in a relatively narrower field of specialization than is required for the bachelor's degree. This degree is regarded as sufficient qualification for entry into many professional positions in the new graduate's field of specialization, including those in college teaching and basic research, but without a doctor's degree the range of employment opportunities and possibilities for advancement are both restricted. Holders of master's degrees are considered well qualified professionally for high school teaching posts, although a teaching certificate is an additional requirement for such positions in public schools.

The Ph. D. degree is generally considered essential to full professional status in the biological

sciences. It is practically a necessity for higher level teaching positions, and is extremely important for positions involving independent research, which usually require the full training and demonstrated capability represented by a Ph. D. degree. In some fields of specialization, notably genetics and most aspects of experimental biology, an overwhelming majority of the personnel have Ph. D.'s.

Some scientists with a medical degree teach or do basic research in the life sciences, particularly anatomy, physiology, or medical applications of microbiology. They frequently hold additional degrees in biological sciences, obtained in the course of further training in their chosen specialty, and such training is usually equivalent to the Ph. D.

In addition to training in biological science subjects, persons planning to specialize in these sciences need training in chemistry, in physics, and, to an increasing degree, in mathematics. Biometry, biostatistics, and other methods of mathematical analysis are becoming important tools in the biological sciences. Extensive training and practice in laboratory techniques and the use of laboratory equipment is also very important. Most research and teaching in the biological sciences require skill in laboratory work which can be developed only through practice.

There has been a definite upward trend in the educational qualifications needed in these sciences. There are a few fields in which the Ph. D. degree is a virtual requirement, and it is becoming more important to employment and to the better positions in all fields.

Employment Outlook

The general employment situation was good in 1956 for biological scientists as a group. Qualified graduates at all levels of training were able to find employment related to their specialties, and certain highly trained specialists—for example, physiologists, pathologists, and biophysicists with Ph. D. degrees—were particularly in demand.

The outlook for the near future, through the early 1960's, is probably about the same. There will be good opportunities for well-trained persons, especially those with Ph. D.'s. However, there is likely to be continued competition for the better positions in many fields of specialization, and some specialities will offer wider employment opportunities than others. The demand for persons with bachelor's degrees to work as technicians will undoubtedly grow with the growth of the sciences as a whole. But continued rise in the educational qualifications required for biological science positions—which is to be expected— would mean further limitations on advancement opportunities for persons without graduate degrees.

The biological sciences have been and are a growing field, and their growth has never been more rapid than in the past decade, but it has proceeded at a slower pace than that of the physical sciences as a group. One of the main reasons for this difference is that the physical sciences have benefited from large expenditures for research and development in connection with national defense, in which the biological sciences have had only a limited share.

Nevertheless, growth in research expenditures may be the most important factor tending to increase demand for biological scientists over the long run. In these as in other scientific fields, expenditures for research and development have been rising since the end of World War II. (See p. 142.) Research in the biological sciences is being actively supported on an increasing scale by several government agencies and by a number of private foundations. In most cases, the public or private organization supporting research has a particular objective, such as a health problem, which it seeks to advance. However, the many different aspects to these complex problems lead to support of a wide variety of research projects calling for many types of biological scientists.

Another important factor which will tend to increase the demand for biological scientists is the substantially larger college and university enrollments expected in the 1960's and thereafter. The resulting increase in demand for teachers will be, to a large extent, for Ph. D.'s, for whom college teaching is a major field of employment. However, there will also be an increase in college openings for qualified holders of master's degrees. (For statement on college teaching opportunities, see index.)

Thus, over the long run, the outlook for the biological sciences is one of substantial continued growth, although the rate of growth is uncertain and the specialties which will be most affected can be described in only the most general terms. The potentialities for research in the biological sciences are many. In the complex problems of

human health and disease, in applications of biology to industrial problems, and in other areas, completion of research projects serves only to highlight the need for new research and for specialists well qualified to conduct it.

Earnings and Working Conditions

The 1954–55 survey of biologists sponsored by the National Science Foundation revealed a median annual salary of about $6,275 for the persons covered by the survey. Those with a Ph. D. degree had a median annual salary of about $6,750, while for those without the Ph. D., all of whom had a bachelor's degree plus 4 or more years of experience, the figure was about $5,850.

The income of biological scientists, like that of almost everyone else, has risen in recent years. For example, a similar survey made in 1951 found the median annual income of Ph. D.'s to be about $6,200, indicating an increase of about $550 from 1951 to 1954–55. Incomes have increased further since 1955.

Where To Go for More Information

American Institute of Biological Sciences,
2000 P St. NW., Washington 6, D. C.

Federation of American Societies for Experimental Biology,
9650 Wisconsin Ave., Washington 14, D. C.

U. S. Department of Agriculture,
Washington 25, D. C.

Animal Sciences

Nature of Work

Animal scientists are concerned with the study of the basic processes of human and animal biology. Specialists in the various aspects of animal science are the largest group of biological scientists. The majority of animal scientists teach or do research, and many do both.

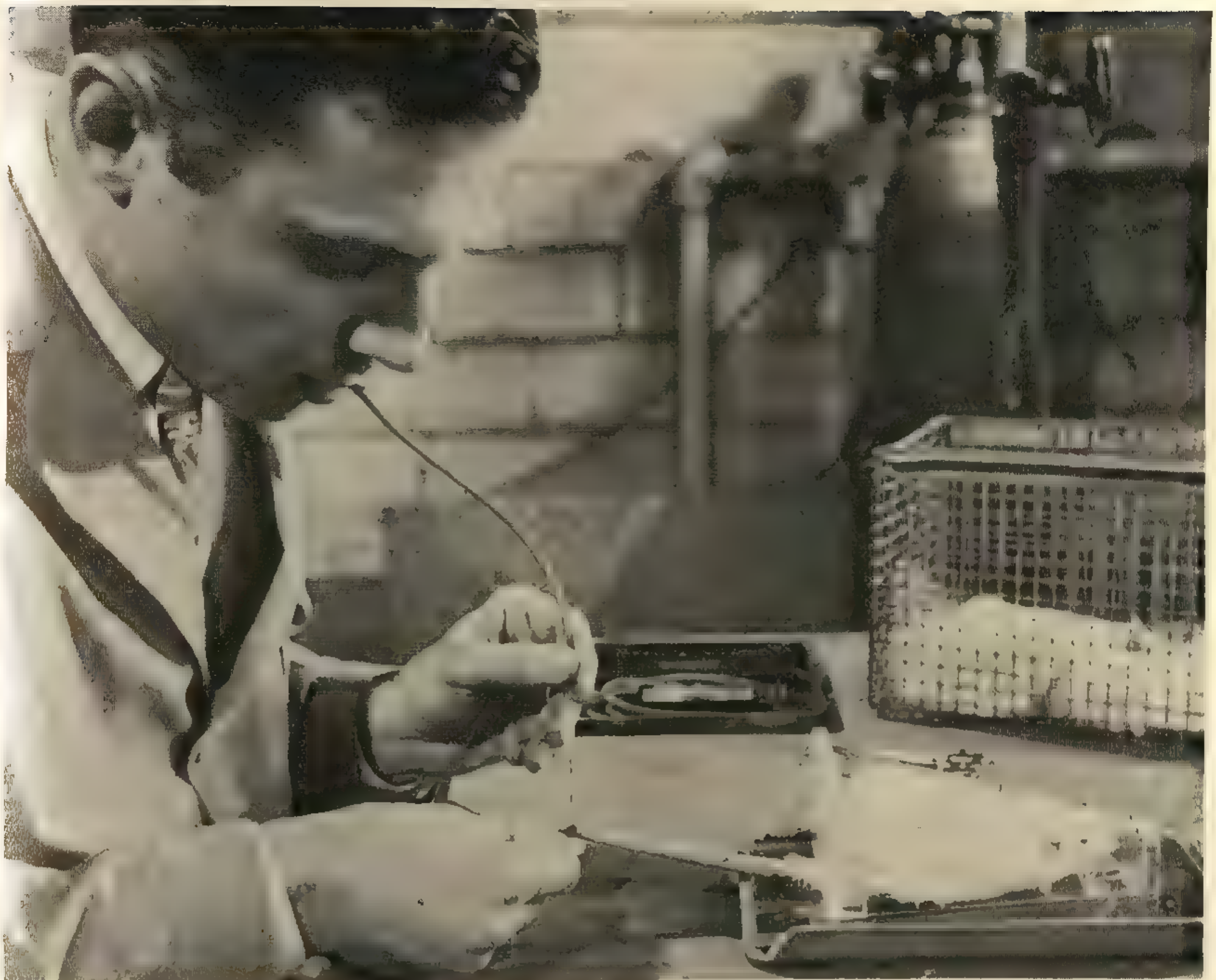
There are many occupational specialties in the animal sciences. Some of the larger broad divisions are entomology, zoology, physiology, anatomy, pathology, and the science of nutrition.

Entomologists are concerned with the study of insects and the ways in which they affect human beings, animals, and plants. Some entomologists specialize in identifying and classifying insects—an enormously difficult undertaking, since there are more than 75,000 species of insects in the United States and Canada alone. This is an important field because proper identification of insects is basic to controlling them and thus to preserving food supplies and controlling disease. Many entomologists are engaged in research on methods of insect control through the use of chemicals, predatory birds, other insects, other biological methods such as insect diseases, or mechanical means. Other entomolgists study ways of utilizing beneficial insects—for example, honeybees, which not only produce valuable quantities of honey and wax but are also essential in pollinating crops so that they will mature and yield good harvests.

Zoologists include students of all phases of animal life—the origin, classification, life history, behavior, life processes, diseases, and parasites of animals, and the ways in which animals influence and are influenced by their environment. Some zoologists make field trips to study animals in their natural environment and collect specimens. Others work mainly in laboratories, dissecting and studying dead animals or conducting experimental studies with live ones. Zoologists who specialize in the study of certain classes of animals usually identify themselves with their specialties, which include, for example, the study of birds (ornithology), snakes (herpetology), fish (ichthyology), and mammals (mammalogy). Teachers and others whose work cuts across several of the animal science fields usually use the title of zoologist.

Physiologists study the functioning of organisms during life and how life processes operate. They may specialize in the study of the heart, circulatory system, glands, nerves, cell activities, or digestive, excretory, reproductive, or other systems. They conduct experiments to determine the effects of environmental factors on life processes. The knowledge gained in such studies provides the basis for the work of many other specialists, such as pathologists, pharmacologists, or nutritionists.

Anatomists study the form and structure of animal organisms. They may study structures visible to the naked eye, those of microscopic size, the development of organisms before birth (embryology) or the structure and organization of any of the specialized organs of animals. Most anatomists specialize in human anatomy.



COURTESY OF U. S. ATOMIC ENERGY COMMISSION

Physiologist removing blood from a rat's tail vein in an experiment to determine whether cysteine—an amino acid—will prevent the oxidation of tissue and cell destruction that result from radiation.

Pathologists study the causes and processes of disease, degeneration, and abnormal functioning in animal organisms. They may specialize in the study of the effects of diseases, parasites, and insect pests on organs and tissues; in histology, which is the microscopic study of animal and plant tissues; or in the structure or anatomy of diseased organs. The term pathologist is normally reserved for students of human pathology (medical pathology); specialists in animal pathology are usually veterinarians; and plant pathologists study plant diseases.

Nutritionists study the processes through which human beings and other animals utilize food; the kinds and quantities of food elements—such as minerals, vitamins, fats, sugars, and proteins—which are essential to maintain the best state of health; and how these food elements are transformed into bodily substances. Nutritionists also make analyses of foods to determine their composition in terms of the food elements essential to nutrition.

Where Employed

More than half of all animal scientists are employed by colleges and universities. About a third work for agencies of the Federal and State Governments, usually the former. Fewer than 1 in 10 works for manufacturing industries, and a still smaller number are employed by research and consulting services, foundations, and various nonprofit organizations.

The animal scientists employed by the Federal Government are chiefly entomologists, parasitologists, and animal physiologists on the staffs of the Departments of Agriculture, Defense, and Health, Education, and Welfare. In State governments, the main employers of animal scientists are the State agricultural experiment stations, which utilize entomologists, nutritionists, and other types of specialists in research work.

Entomologists are predominant among the animal scientists in private industry. Food companies, particularly large milling and baking companies, employ them to develop methods of protecting stored foods from insect pests, and chemical firms use them to do research in developing and testing insecticides. In addition, entomologists are employed to provide technical services in connection with the sale and proper use of insecticides.

Training and Other Qualifications

The level of education needed for entrance into the animal sciences is determined largely by the field of specialization and the type of work performed. The educational requirements of different types of employment are greatly influenced by these two factors.

The bachelor's degree is sufficient training for employment only in certain segments of the animal sciences—for example, entomology. In general, the bachelor's degree is sufficient preparation for certain positions connected with the administration and enforcement of government regulations designed to prevent the spread of diseases or to control pests, and for other jobs involving fairly routine functions. The master's degree in one of the animal sciences is sufficient qualification for some teaching positions in colleges and universities, and for some research positions. The Ph. D. degree, however, is generally considered essential for the attainment of full professional status in the animal sciences. It is practically a necessity for higher level teaching appointments, and for positions involving independent research into basic problems. Top-level positions in teaching, basic research, and administration require the full training of the Ph. D.

In summary, although there are positions in some of the animal sciences for persons holding only the bachelor's degree, graduate training is often needed to compete for the better jobs. Persons interested in careers in the animal sciences should obtain graduate training, and preferably a Ph. D. degree, if at all possible.

Employment Outlook

Employment opportunities for animal scientists were good in 1956 and were expected to remain good at least through the early 1960's.

Expenditures for scientific research in the animal sciences have been increasing since the end of World War II. In recent years, the Federal Government has given increased support to this research—notably through the National Institutes of Health and the National Science Foundation. The U. S. Department of Defense is also an important source of research funds for the animal sciences. Voluntary health agencies, such as the cancer, tuberculosis, and heart societies, also support basic biological research in the animal sciences. The trend toward increased expenditures for research in the animal sciences is expected to continue.

The substantially increased college and university enrollments expected in the 1960's and thereafter will bring an increased demand for teachers in this field as in all others. The increased demand for teachers and for research personnel, is expected to lead to continued growth of employment in the animal sciences.

For information on *Earnings and Working Conditions* and *Where To Go For More Information* and for further information on *Employment Outlook*, see the *Introduction* to this chapter.

Plant Sciences

Nature of Work

Plant scientists are divided among three main fields of specialization—botany, plant pathology, and plant physiology—each of which includes a number of subspecialties. These scientists, a much smaller group than animal scientists, chiefly teach and do research.

Botanists are concerned with basic knowledge of plants in general, rather than with any one of the various specialized fields which have developed from the general field of plant study. Some botanists are interested primarily in the identification and classification of plants (plant taxonomy). Others specialize in studies of the structure of plants and plant cells (plant morphology and histology), or in studies of the influence on plants of such environmental factors as rainfall, temperature, and soil (plant ecology). Another important field of botany is the collection of basic information on the raw material resources which human beings obtain from plants (economic botany).

Plant pathologists (also known as phytopathologists) are specialists in the causes and control of plant diseases produced by parasitic organisms, viruses, chemicals, and other agents. Some specialize in the pathology of a specific plant or group of plants, such as forest trees, vegetable crops, ornamental plants, and field crops. Others work only with certain organisms or groups of organisms affecting plants, such as fungi, viruses, or bacteria.

Plant physiologists study the life processes of plants—the ways in which they grow, develop, and reproduce. They are concerned with the ways in which plants are affected by nutrients and other chemicals and by environmental factors, such as soil, temperature, moisture, and light. They also study the effects of certain chemicals—such as growth regulators, fungicides, and insecticides—on the development of plants and the quality of plant products.

Where Employed

The majority of plant scientists are employed in colleges and universities. The second largest group work for government agencies, both Federal and State. The remainder, a relatively small proportion, are employed by private industry and by foundations and other nonprofit organizations.

Training and Other Qualifications

The Ph. D. degree is needed for full professional development in the plant sciences, as in most areas of biology. It is of first importance for college and university teaching, which is the chief source of employment for plant scientists, and it is equally important for research. In both college teaching and research, there are positions for persons with master's degrees, but the opportunities for advancement open to them are likely to be limited. People with the bachelor's degree can work as technicians in the plant sciences, but it is extremely difficult to rise to higher positions without a graduate degree, preferably the Ph. D.

With few exceptions, undergraduate majors in plant science specialties are not offered by colleges. It is generally recommended that students obtain, during the first 4 years of college, the broadest possible training in all branches of biology and in related sciences. The competent biologist needs to have both an intensive knowledge of his own specialty and a broad background in the fundamentals of biology and related sciences in order to interpret better the results of his studies and experiments. Training in chemistry, physics, mathematics, and statistics is also needed by plant scientists.

Employment Outlook

The employment situation was good in 1956 in the relatively small field of the plant sciences, and it was expected to remain fairly good for the next few years.

The most important factor tending to increase employment in this field of science is the higher college and university enrollments expected in the late 1950's and thereafter. This will create a demand for plant scientists with Ph. D. degrees primarily, but there will be increased demand for plant scientists with master's degrees as well, to teach the increasing number of students.

Another important factor which will probably tend to increase employment of plant scientists over the long run is the increasing support of research, by private firms as well as by government agencies. Much of this support is given in connection with agricultural research, but there has been increased support for other aspects of plant science research as well.

For information on *Earnings and Working Conditions* and *Where To Go for More Information*, and for further information on *Employment Outlook*, see the *Introduction* to this chapter.

Microbiology

Nature of Work

Microbiologists specialize in the study of bacteria, viruses, molds, and other organisms of microscopic or smaller than microscopic size. The terms microbiology and bacteriology are sometimes used interchangeably, but microbiology is the broader term and is preferable when referring to the study of all microscopic organisms. Like other biological scientists, microbiologists usually specialize in some particular aspect of their field.

Agricultural specialists study bacteria, molds, algae, and protozoa and other micro-organisms in soils, and the relation of such organisms to soil fertility; to the growth, processing, and storage of crops; and to plant diseases. They also study micro-organisms which affect the health of animals.

Industrial specialists include scientists who develop methods of using beneficial molds and bacteria in processing dairy products, beer, wine, vinegar, and other food products. Some industrial microbiologists study micro-organisms which attack materials, such as textiles, leather, metal, and wood, to determine the cause of spoilage or deterioration. Many industrial microbiologists are engaged in research on antibiotics and other products produced through the aid of micro-organisms, in a search for new products or new methods of production. Testing and inspection of biological production is another important aspect of their work.

Medical specialists study organisms which cause infectious diseases. They aid in the diagnosis of diseases by identifying disease-producing organisms found in body fluids or excretions and provide information about the sensitivity of such organisms to various remedies. Virology (the study of viruses causing diseases in animals or plants), immunology (the study of the mechanisms by which the body fights off infection), and serology (the study of animal fluids, including blood serum) are closely related fields.

Public health specialists apply the findings of microbiology in maintaining health standards for water supplies, milk, and other foods, and in the control and prevention of contagious diseases.

Where Employed

Colleges and universities are the largest employers of microbiologists with graduate degrees, with private industry second as a field of employment for this group, and government agencies third. For microbiologists with only bachelor's degrees, however, private industry is the largest field of employment.

The most important industrial employers of microbiologists at all degree levels are drug and other chemical firms and food processing companies, which use these scientists both in research and in connection with the control of manufacturing processes. Other industrial employers are paper and leather manufacturers.

Most of the microbiologists and bacteriologists working for the Federal Government are employed by the Public Health Service, the Veterans Administration, the Department of Agriculture, and the Department of the Army. Those employed by State and local governments work in public health departments and as research workers at agricultural experiment stations.

Training and Other Qualifications

The minimum training requirement for positions in microbiology is a bachelor's degree. This degree is adequate preparation for a variety of positions in private industry and in government agencies, which involve testing and inspection or routine research performed under the direction of a senior research worker.

For more independent research and for entry positions in teaching, the master's degree is needed. In microbiology as in other biological sciences, this degree usually indicates that the individual has received considerable training in some field of specialization and is thus qualified for entry positions in this specialty.

The Ph. D., however, is generally considered essential for the attainment of full professional status in microbiology, like most other biological sciences. It is practically a necessity for higher level teaching appointments, and for positions involving independent research into basic problems.

Persons interested in these types of work will find their opportunities restricted without the Ph. D.

Training in physics and mathematics is valuable in microbiology, as in other biological sciences, and extensive training in chemistry is essential.

Employment Outlook

The employment situation for microbiologists with graduate training was good in 1956, but there was competition for jobs as technicians or junior research workers among those with only bachelor's degrees. The situation was expected to remain very much the same for the next several years.

The field of microbiology has experienced a steady growth in the past, which will probably continue for some time. The United States Government has given increased support to both basic and applied research in microbiological specialties, principally through the National Institutes of Health, the National Science Foundation, and the Department of Defense. The research expenditures of private industry and of various private nonprofit agencies have also been increasing. The potentialities of microbiological research for both industrial and medical applications are very large, and the trend toward increased expenditures for research and for product development activities in microbiology is likely to persist, creating new employment opportunities at all levels of training but most especially for Ph. D.'s capable of undertaking independent research and directing the research activities of others.

The greatly enlarged enrollments expected at the colleges and universities in the next decade will also increase opportunities in teaching for microbiologists with doctor's or master's degrees, especially the former.

For information on *Earnings and Working Conditions* and *Where To Go for More Information*, and for further information on *Employment Outlook*, see the *Introduction* to this chapter.

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SOCIAL SCIENCES

The Social Science Professions

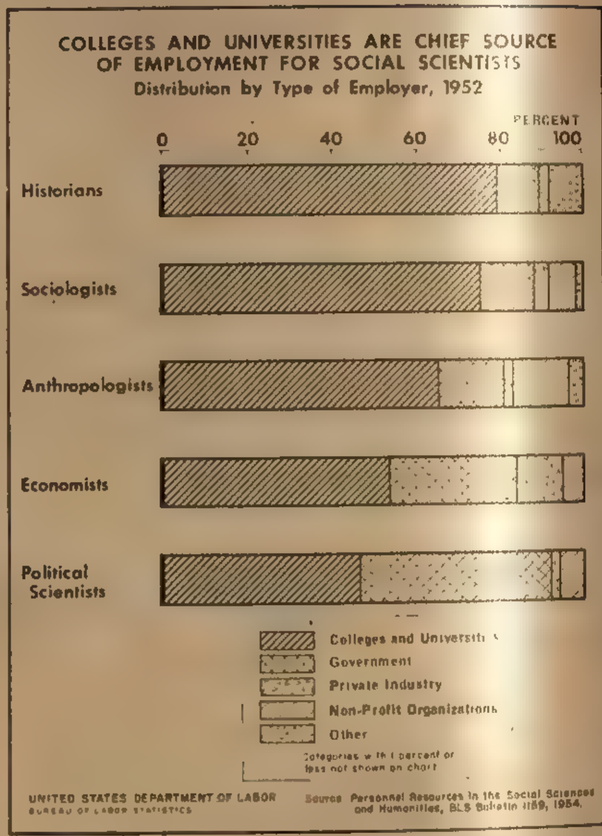
The social sciences are concerned with the whole range of human history and activities, from the origin of man to the latest election returns. Social scientists, however, generally specialize in one of several major branches of social science, each of which is a study of human behavior from a different viewpoint. Those specializing in anthropology study primitive tribes, reconstruct lost cities and civilizations, and are concerned with the cultures and languages of all nations. Economists study the ways in which men make a living and analyze the factors which help or hinder them in satisfying their material needs. Historians describe and interpret the events of the past. Political scientists are concerned with the problems of government. Sociologists deal with the behavior and relationships of groups, including the family, the community, minorities, and others.

Besides these basic social science fields, there are a number of closely related fields, some of which are covered in separate statements in this Handbook. (See statements on statisticians, psychologists, and social workers.)

An estimated 35,000 people were professionally employed in the basic social sciences in 1956; fewer than 10 percent of the total were women. Because of overlapping—not only among the closely related basic social science fields but also with such fields as business administration, foreign service work, and high school teaching—it is extremely difficult to determine exactly the size of each social science profession. Economists are, however, the largest group of social scientists, followed by political scientists, historians, sociologists, and anthropologists.

The majority of all social scientists are employed by colleges and universities. (See chart 29.) The Federal Government is the second largest employer, especially of political scientists and economists. Except for economists, private industry employs comparatively few persons in professional social science positions, but there is a trend toward hiring increasing numbers of college graduates who have majored in the social sciences as trainees for administrative and executive positions in a variety of industries. Research councils and other nonprofit organizations provide an important source of employment for anthropologists and sociologists.

CHART 29



Training and Other Qualifications

Graduate training is required for most professional work in the social sciences. Completion of all requirements for the Ph. D. degree, except the doctoral dissertation, is commonly required for appointment to the position of college instructor in large colleges and universities, and the doctorate is a prerequisite for appointment to the rank of professor in many colleges and universities. Undergraduate training is sufficient for appointment to many beginning positions in the Federal Government, but persons with graduate degrees may enter at a higher grade. Even in private industry where a high proportion of currently

employed social scientists have only bachelor's degrees, there is growing emphasis on the importance of graduate training for professional positions.

The great majority of all social scientists have graduate degrees. However, the proportion holding a Ph. D. degree varies considerably by field of specialization. For example, nearly 70 percent of the historians included in a recent survey had the Ph. D. degree, but only about 40 percent of the political scientists had attained the doctorate.

Employment Outlook

Employment in the social sciences is expected to increase moderately during the remainder of the 1950 decade and more substantially during the 1960's, largely because of the anticipated increase in need for teachers in colleges and universities. (See statement on college and university teachers, page 63.) Some increase in employment is also expected in both government and industry, as a result of the growing reliance on the use of social science methods in solving the economic and social problems of industry and the Nation. In addition to personnel required for new positions, more than 1,000 social scientists will be needed each year to replace those who die, retire, or leave for other employment.

The supply of professional personnel in the social sciences comes largely from students obtaining graduate degrees. In the 5-year period ending June 1955, about 20,000 master's degrees and 5,000 Ph. D. degrees were awarded in the social science fields. (See table.) It is anticipated that during the next 10 years (1956–65), 3 times as many master's and doctor's degrees will be granted as in the earlier 5-year period. These estimates are based on the assumption that the proportion of social science degrees granted will remain the same as during recent years and that college enrollments and graduations will continue to rise as rapidly as current forecasts suggest.

Employment opportunities for new Ph. D.'s were good in 1956 and will probably continue to be favorable in most social science fields during the remainder of the 1950 decade and the early 1960's, despite the anticipated rise in the number of degrees granted in the social sciences. Economists with the Ph. D. degree and those with all the Ph. D. requirements except the doctoral dissertation are expected to find exceptionally good employment opportunities and it is likely that those with only a master's degree will also have good opportunities, provided they are well trained in a particular specialty and in statistical research methods. In the other social science fields, those with only master's degrees may meet considerable competition for professional positions.

College graduates with only a bachelor's degree in the social sciences are likely to find opportunities for professional employment increasingly limited. Many of these graduates will probably find work in related fields of business or public administration, social work, and high school teaching; a considerable number will enter fields of work unrelated to their field of study. However, education in the social sciences has a basic value other than vocational training—that of helping individuals to meet their personal and social responsibilities in everyday living.

Total number of graduate degrees conferred by higher educational institutions in the social sciences, 1951–55

Subject field	Master's degree	Ph. D. degree
All social sciences	21, 161	4, 946
Anthropology	409	211
Economics	3, 312	1, 183
History	6, 851	1, 608
Political science [1]	5, 227	954
Sociology	2, 519	778
Social science, not elsewhere classified	2, 843	212

[1] Includes international relations and public administration.

SOURCE: Compiled from U. S. Office of Education, Annual Reports on Earned Degrees Conferred by Higher Educational Institutions.

Earnings

Starting salaries for social scientists employed as instructors ranged from $3,000 to $4,000 in large colleges and universities in 1956. Generally, positions with the higher salaries required the Ph. D. degree, or completion of all requirements for this degree except the doctoral dissertation, and some experience—often obtained as a graduate teaching assistant. In a majority of colleges and universities, salaries of professors were roughly double the instructor's salary, and in a few cases consid-

erably more than double. (See statement on college and university teachers.)

In 1956, beginning salaries for social scientists entering the Federal Government in professional or administrative positions were $3,670 a year for inexperienced graduates with only the bachelor's degree and $4,525 for those with the master's degree or equivalent in education and qualifying experience. All new candidates for such positions were expected to meet the requirements of the Federal Service Entrance examination. (See section on The Federal Government.)

Entrance salaries for social scientists hired as business trainees in private industry are generally comparable with those offered other college graduates for similar employment. Beginning salaries for men graduates with a major in economics and considerable training in business related subjects were around $350 a month in 1956. Starting salaries of social scientists entering the field of market research were somewhat lower. Salaries of social scientists entering nonprofit organizations were about $300 a month for research positions and slightly lower for administrative and operating positions, particularly in the field of social welfare and recreation work.

Women social scientists generally had substantially lower starting rates than men in 1956, partly because they were more frequently employed by nonprofit organizations or were employed in nonprofessional jobs. Women social scientists, performing the same type of work as men, generally earn substantially less than men of comparable age, experience, and level of education. A 1952 survey of earnings of social scientists indicated that women Ph. D.'s earned on the average about $1,000 less than men, even though they were an older, and presumably more experienced, group.

Social scientists in fields which have a relatively high proportion of workers employed by the government and private industry earn more, on the average, than those in specialties largely confined to college and university employment. The 1952 survey of the earnings of social scientists indicated that median annual salaries of economists and political scientists were $6,500 and $5,900, respectively, and those of historians, sociologists, and anthropologists were $5,300 or less. Average salaries have risen since that date—perhaps as much as 10 percent by 1956.

In all fields, social scientists with the Ph. D. degree earned substantially more, on the average, than did those with the master's degree, as shown in the following tabulation of median annual salaries received in 1952.

Occupation	*Master's degree*	*Ph. D. degree*
Anthropologists	$4,500	$5,800
Economists	5,400	7,200
Historians	4,200	5,500
Political scientists	5,300	6,100
Sociologists	4,100	5,800

Salaries of social scientists employed by colleges and universities vary little by subject specialty; in 1952, median salaries ranged from $5,000 for historians to $5,500 for economists. Salaries in large institutions with many graduate students tend to be substantially higher, especially for professors, than salaries in smaller institutions.

Many social scientists earn income in addition to their regular salaries. Summer teaching is the principal source of such income in all fields, but consulting work is an important source of supplementary income for economists, political scientists, and sociologists. Income from royalties is a more common source of supplementary earnings for historians. Social scientists regularly employed by colleges and universities are the group most likely to have additional earnings. Comparatively few Federal Government employees have supplementary income; when they do, their chief additional activity is teaching.

Where To Go for More Information

Additional information, particularly on employment trends and outlook, is given in the following publication:

> Employment Outlook in the Social Sciences, Bureau of Labor Statistics Bull. 1167, 1954. Superintendent of Documents, Washington 25, D. C. Price 30 cents.

The results of a survey of the characteristics and earnings of social scientists are published in the following report:

> Personnel Resources in the Social Sciences and Humanities, Bureau of Labor Statistics Bull. 1169, 1954. Superintendent of Documents, Washington 25, D. C. Price 70 cents.

Additional information on educational requirements for economists and sociologists may be found in the following publications prepared by

the Bureau of Labor Statistics for the Veterans Administration:

Educational Requirements for Employment of Economists, VA Pamphlet 7-8.4, 1955. Superintendent of Documents, Washington 25, D. C. Price 15 cents.

Educational Requirements for Employment of Sociologists, VA Pamphlet 7-8.8, 1955. Superintendent of Documents, Washington 25, D. C. Price 15 cents.

Information on the respective branches of social science may be obtained from the following professional organizations:

American Anthropological Association,
Logan Museum, Beloit College, Beloit, Wis.

American Economic Association,
Northwestern University, Evanston, Ill.

American Historical Association,
Library of Congress Annex, Washington 25, D. C.

American Political Science Association,
1726 Massachusetts Ave. NW., Washington 6, D. C.

American Sociological Society, New York University,
Washington Square, New York 3, N. Y.

Information on opportunities in related fields of work in the foreign service is given in:

New Opportunities in the U. S. Foreign Service, U. S. Department of State Publication 6284, 1956. Superintendent of Documents, Washington 25, D. C. Price 15 cents.

Information on how to find out about U. S. Civil Service examinations in social science and related fields is given in section on The Federal Government.

Anthropologists

(D. O. T. 0–36.01)

Nature of Work

Anthropology, the study of man and his works, is the smallest of the social science fields. Probably not more than a thousand persons, including archeologists, were professionally employed in this field in 1956. More than a fifth were women—a higher proportion than in any other social science field.

Most anthropologists specialize in cultural or social anthropology—usually in either archeology or ethnology. Archeologists visit the places where earlier civilizations are buried and make excavations to look for the remains of people and their homes, clothing, utensils, and ornaments. For example, archeologists working in Asia Minor are digging up the temples of the Hittites and have found whole libraries of hieroglyphics, which reveal the history of a people once powerful enough to challenge the Egyptian Pharaohs but completely forgotten until recent times. Archeologists working in the sands of New Mexico are salvaging the remnants of Indian village civilizations before they are destroyed by the tide of new highways under construction there. The reconstruction of Williamsburg, Va., illustrates the work of archeologists in reconstructing the life of colonial America. Ethnologists may spend long periods living among primitive tribes, under difficult conditions, so they can learn their ways of life at first hand. The ethnologist takes accurate, detailed, and complete notes describing the physical characteristics of the people, their social customs and material possessions, usually learning their language in the process. He also collects examples of their pottery, tools, weapons, and other articles.

Few persons specialize in physical anthropology. These anthropologists apply intensive training in human anatomy and biology to the study of human evolution and growth, and to the scientific measurement of the physical differences among the races of mankind.

College teaching is the principal function of most anthropologists. However, research is the major work of nearly one-third of all anthropologists, including many in government agencies and nonprofit organizations, as well as a substantial proportion of those employed in colleges and universities. A good many are employed in library and museum work, administration, or operational activities. A few are engaged primarily in consulting, writing, or other activities.

Where Employed

Most teachers of anthropology are on the faculties of the small group of institutions (24 in 1955) conferring graduate degrees in anthropology. Anthropologists in other types of work are em-

ployed in museums, libraries, areas under government supervision—parks, monuments, trusteeship territories and others—and frequently in foreign lands, at the sites of field explorations financed by research organizations. (See chart 29.)

Training and Other Qualifications

Persons with bachelor's degrees in anthropology may occasionally qualify for teaching assistantships or for positions as field or research assistants, particularly in connection with archeological studies. However, it is increasingly difficult for those without graduate training to obtain any but temporary positions in this field. The usual minimum entrance requirement for professional work in anthropology is a master's degree and some experience in field work. New graduates with master's degrees in anthropology may qualify for positions as instructors in colleges and universities and for entrance positions in research and administration or library and museum work. Although it is occasionally possible to advance to higher level positions on the basis of experience, it is generally necessary to obtain the Ph. D. degree for better positions in all fields of employment.

Some training in physical anthropology and in archeology is necessary for all anthropologists. Trained anthropologists are also expected to obtain experience by doing basic research in the field. Undergraduate students may begin their field training by accompanying expeditions as laborers. They may gradually advance to supervisory positions in charge of the digging or collection of material and may finally take charge of a portion of the work of the expedition. Most anthropologists prepare doctoral dissertations based on data collected in the course of independent field research; they are, therefore, experienced fieldworkers by the time they obtain the Ph. D. degree.

Employment Outlook

Employment opportunities were good in 1956 for highly trained anthropologists in most fields of specialization. However, there appeared to be an oversupply of social anthropologists owing to the sharp decline during the early 1950's in the use of anthropologists as program officers and consultants in foreign aid programs. In most fields of anthropology, persons without the doctorate faced very keen competition for professional positions in 1956, since demand was limited largely to replacement needs. Those specializing in archeology had somewhat better employment opportunities as a result of some new government projects involving the salvage of objects of archeological value that might be destroyed by the proposed vast network of new highways. These salvage operations, financed partly by Federal funds and partly by State museums and universities, also provided a considerable number of temporary summer jobs for students of anthropology and were expected to continue to do so for the remainder of the 1950's at least.

Employment of anthropologists by colleges and universities is expected to rise slowly during the remainder of the 1950 decade and substantially during the 1960's (see statement on college teachers on p. 63). An average of 40 to 50 instructors may be needed annually to meet the needs resulting from expansion in college faculties and the replacement of faculty members who retire, die, or leave for other types of work. Employment of anthropologists in other fields of work is likely to remain fairly stable—with new hiring limited largely to replacements, which may not exceed 25 a year.

New graduates with Ph. D.'s in anthropology will probably have favorable employment opportunities through the early 1960's, at least (assuming that the proportion of graduate students specializing in this field does not become substantially higher than in recent years). Graduates with only the master's degree, however, are likely to face persistent competition for professional positions. Those with training in social psychology may find positions in related fields of work, especially in personnel and industrial relations and in public opinion and market research. Others may find jobs in public administration and in nonprofit organizations and civic groups, which prefer personnel with social science training as a general background.

Information on *Earnings* and *Where To Go for More Information* is given at the beginning of this chapter.

Economists

(D. O. T. 0–36.11)

Nature of Work

Economics is the largest of the basic social science fields, with about 15,000 persons employed primarily as economists in 1956. In addition, many other people not classified as economists were employed in work which required some training in economics.

Economists study the ways in which men make their living and the factors which determine their success or failure in satisfying their material needs. All economists must have a broad background in economic theory; most specialize in one or more fields in which economic principles are applied. Some economists are concerned with such problems as the control of inflation, the prevention of depression, and farm, wage, tax, and tariff policies. Some develop comprehensive theories to explain the causes of employment and unemployment or the ways in which international trade influences world economic conditions. Others are concerned with the collection and interpretation of data on a wide variety of economic problems.

Economists are employed principally as teachers in colleges and universities, as professional workers on economic research projects in government agencies, and, to a lesser extent, in private industry and nonprofit research organizations. (See chart 29.) Those employed as college teachers not only guide students in learning the basic principles and methods of economics but frequently engage in writing, lecturing, or consulting activities. They do much of the basic research on fundamental problems in economic theory and formulate many of the new theories and ideas which directly or indirectly influence economic thought in industry and government.

Most government economists do research and administrative work. They may plan and carry out studies involving the collection of basic economic data and may use these data to analyze problems in such areas as the consequences of changes in technology, industrial organization, government policy, or the demand for and supply of goods or manpower. They write reports on their findings and may be called upon to present reports before policymaking bodies. The largest numbers of economists in the Federal Government are specialists in agricultural, business, international

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

An economist using statistical charts to explain employment trends.

trade and development, labor, and fiscal economics. In addition, many economists in the Federal Government are employed as statisticians, foreign affairs specialists, intelligence specialists, or as professional workers in other positions which require substantial training in economics.

Economists employed by large business firms perform mainly administrative and research duties. They may concentrate on problems relating to domestic business conditions, markets and prices of company products, government policies affecting business, or international trade. Their main purpose is to provide management with information to be used in making decisions on problems such as the timing of new financing or the advisability of expanding the company's business by adding new lines of merchandise or by opening branch plants in new areas. Some economists are self-employed and act as consultants, mainly to business firms.

Where Employed

About half the professional economists are employed by colleges and universities; approximately a third work for government agencies—primarily Federal; a small but growing number are employed by private industry; and a few serve in research agencies and community organizations.

Economists are found in nearly all university towns and cities. The largest number of econo-

mists are in the Washington, D. C., area, where more than three-fourths of the economists in the Federal Government are located. Economists in private industry are usually employed in cities where the home offices of large corporations are located. The New York City and Chicago metropolitan areas have the largest concentration of economists in private industry, as well as in nonprofit research organizations.

Training and Other Qualifications

A bachelor's degree with a major in economics is sufficient for many beginning research jobs in government and private industry, although persons employed in such jobs are not always regarded as professional economists. All economic research work requires a good background in the core subjects—economic theory, history, and measurement. Since beginners are usually concerned mainly with the collection and compilation of data, a thorough knowledge of statistical procedures is especially important. Those who have had several courses in mathematics and statistics usually have better employment opportunities than those with only the minimum requirements in these subjects. It is possible to advance to more responsible research jobs involving considerable analysis or supervisory duties on the basis of experience, but there is a trend toward requiring further academic training for advancement to high-level positions.

Young people with bachelor's degrees in economics can usually qualify for the same types of jobs as most college graduates with a major in business administration. Industrial and business firms often hire graduates as management trainees, rotate them through various departments to acquaint them with company activities, and then assign them to positions where they are most needed or best fitted. Whether or not the employee is finally assigned a job which makes specific use of his training in economics depends largely on the needs of the company.

The master's degree is generally the minimum requirement for appointment to the position of college instructor, though graduate assistantships may be awarded to outstanding students working toward their master's degree. Completion of all the requirements for the Ph. D., except the dissertation, is necessary for appointment to the position of instructor in many large colleges and universities. In government or private industry, economists with the master's degree can usually qualify for research-related positions of a somewhat higher level than those open to holders of only the bachelor's degree.

The Ph. D. degree is necessary for attaining a professorship in a high-ranking college or university and is an asset in obtaining many types of jobs, such as administrator or director of research projects in the government, a research council, foundation, or business organization.

Employment Outlook

The job market for well-qualified economists is expected to continue to be very good throughout the rest of the 1950 decade. In 1956, the demand for economists was strong, and shortages of personnel with experience or graduate work were reported in some specialized fields, particularly in agricultural marketing economics and transportation. The shortage of agricultural marketing economists was largely the result of a pronounced increase in demand, beginning in the mid-1950's, for personnel to do research in the various State agricultural experiment stations. In addition, the slow but steady rise in the use of marketing economists in private industry continued. During the late 1950's, a moderate rise in the demand for economists in the Federal Government and in private industry, coupled with a marked increase in the demand for economists to teach in colleges and universities, is expected to create numerous employment opportunities for economists with graduate training. Although inexperienced college graduates with only a bachelor's degree in economics will have few opportunities for employment as professional economists, they will probably continue to be in demand as market research assistants and as administrative and management trainees in industry and government.

Employment of economists will increase substantially in the college teaching field during the 1960's (see statement on college teachers) and to a moderate extent in other fields. Colleges and universities may need as many as from 500 to 600 new instructors annually to handle rapidly increasing college enrollments and to replace faculty members who retire, die, or leave for other fields of work. Several hundred economists are also likely to be required annually to meet expansion and replacement needs in industry, gov-

ernment, and nonprofit organizations. Private industry is expected to employ a growing number of economists, as businessmen become more accustomed to relying on scientific methods of analyzing business trends, forecasting sales, and planning purchasing and production needs. Employment of economists in the Federal Government is likely to increase somewhat, as the importance of more extensive data collection and analysis by government agencies is more widely recognized as a guide to policy planning in government and industry. The demand for agricultural economists in the State agricultural experiment stations will continue to rise, if present plans for increased expenditures for research under the Federal Research and Marketing Act of 1946 are carried out.

Employment prospects for economists with the doctorate are expected to be very good—better than for other social scientists—through the early 1960's, at least. Assuming the proportion of graduate degrees granted in economics remains the same as in the post-World War II period, the number of new Ph. D.'s will probably be considerably less than the number of new college instructors needed. As a result, employment opportunities for economists who have fulfilled all requirements for the doctorate except the dissertation will also be very good. Although there may be considerable competition for professional positions among economists with lesser qualifications—in view of the anticipated increase in their numbers—it is likely that most economists with graduate training will be able to find professional employment, especially if they have adequate training in statistics and mathematics. Those with only a bachelor's degree are likely to continue to find relatively limited opportunities for professional employment as economists.

Information on *Earnings* and *Where To Go for More Information* is given at the beginning of this chapter.

Historians

(D. O. T. 0-36.91)

Nature of Work

Historians study the records of the past and write books and articles describing and analyzing past events, institutions, and ideas. They may specialize in the history of a specific country or region or in a particular period of time—ancient, medieval, or modern. Sometimes they study certain phases of history, such as the economic and social life of a country or period; international, diplomatic, military, church, political or cultural history, or other specialized areas. Most historians specialize in United States history or in modern European history. Some historians, usually called archivists, specialize in selecting, preserving, and making available documentary materials of historical value.

Most historians are employed as teachers in colleges and universities. (See chart 29.) Small but increasing numbers are engaged in research and in archival, library, and museum work, mainly for government agencies but also for historical societies, special libraries, and private industry. Frequently, college teachers also do historical research, writing, and lecturing, and are occasionally employed as consultants. Government historians do mainly original research, or administrative work and writing in connection with research projects. They examine, analyze, and evaluate original source materials—letters, memoranda, circulars, official records and reports, books, pamphlets, and articles—and prepare reports and special studies. Historians in the Defense Department may prepare confidential studies based on classified materials or may prepare pamphlets and books for publication. Those engaged in museum or special library work may edit historical materials, prepare exhibits, and do related work. Some are experts in such areas as the development of various types of transportation (trains, cars, aircraft); others are specialists in colonial furniture, art, architecture, costumes, or other objects of historical interest.

Where Employed

Roughly 6,000 to 7,000 persons were employed as historians in 1956, exclusive of high school history teachers, who are not usually classified as historians, although some have had considerable professional training. Approximately 80 percent of the historians were employed in colleges and universities. About 10 percent were employed in Federal Government agencies, principally the National Archives and the Defense Department. Small numbers were employed by other govern-

ment organizations (State, local, and international), by nonprofit foundations, research councils, special libraries, museums, and by large corporations.

Since history is taught in all institutions of higher education, historians are found in all college communities. About half the historians and three-fourths of the archivists in the Federal Government are employed in Washington, D. C. Historians in other types of employment usually work in localities which have museums or libraries with collections adequate for historical research.

Training and Other Qualifications

Graduate education is usually necessary to qualify as a historian. A survey of historians employed in 1952 indicated that more than two-thirds had doctorates and nearly all the rest had master's degrees. While a bachelor's degree with a major in history is sufficient training for many beginning jobs in archival work and may sometimes be accepted for beginning positions in Federal, State, and local governments, persons in such jobs are not usually regarded as professional historians. A major in history in college undergraduate work is often recommended by employing agencies for jobs in international relations and journalism.

Since beginning jobs open to college graduates with only a bachelor's degree in history are likely to be concerned with the collection and preservation of historical data, a knowledge of archival work is helpful. Graduate training or its equivalent in experience is required for advancement to higher level positions.

The master's degree in history is the minimum requirement for appointment to the position of college instructor, but the Ph. D. degree is usually necessary for appointment in a large college and university. The doctorate is indispensable for attaining high-level college teaching, research, and administrative positions in the field of history. Most professional historians in the Federal Government and in nonprofit organizations are required to have the Ph. D. or the equivalent.

Employment Outlook

Employment opportunities for well-qualified historians were better in 1956 than at any time since the Korean conflict, primarily because of the increased demand for college history teachers. The demand for historians in the Federal Government also increased slightly in 1956, mainly in connection with research on defense-related historical studies and museum work. In general, the supply of historians with the Ph. D. degree was adequate to meet the demand. Shortages were reported only in such exceedingly small and narrow specialties as aeronautical history and museum work. Historians with the master's degree faced considerable competition for professional positions, and those with the bachelor's degree had few, if any, opportunities for employment as historians. College graduates who had majored in history were in moderate demand for high school teaching positions and for administrative and management trainee jobs in government. They were also finding some employment opportunities as administrative assistants in nonprofit foundations, civic organizations, and private industry, although such positions were often unrelated to their specific training.

Employment of historians in college teaching is expected to increase moderately during the remainder of the 1950 decade and more rapidly during the 1960's. (See statement on college teaching.) An average of 500 new instructors will probably be needed annually to teach new classes made necessary by expanding enrollments, and to replace those teachers who retire, die, or leave for other types of work. Employment of historians outside the college teaching field is likely to rise very slowly, and will be affected by any change in congressional appropriations for Government agencies using this type of personnel. Probably fewer than 100 new historians will be required annually to fill all vacancies outside the college teaching field.

Historians with the doctorate are expected to have favorable employment opportunities throughout the remainder of the 1950's and the early 1960's (assuming that the proportion of graduate students majoring in this field does not become greater than in recent years). Those with only the master's degree in history will probably continue to encounter keen competition for professional positions, and those with only the bachelor's degree will find it increasingly difficult to advance to professional employment.

Information on *Earnings* and *Where To Go for More Information* is given at the beginning of this chapter.

Political Scientists

(D. O. T. 0–36.96)

Nature of Work

Political science is the study of government—what it is, what it does, and how and why. Political scientists are interested in government at every level—local, county, State, regional, national, and international. The greatest number of political scientists specialize in public administration; many specialize in American Government or international relations, and smaller numbers specialize in fields such as public law, history of political ideas, political parties, and public opinion and area studies.

College teaching is the principal function of political scientists. However, substantial numbers of political scientists are engaged in administrative or operational work, most frequently in the areas of personnel work, budget analysis, municipal or rural administration. Perhaps a tenth of political scientists specialize in research. These research workers may make surveys of government agency operations to discover the amount and kind of work performed and may prepare analyses designed to show how well agency performance accomplishes the intended legislative purpose or what changes in legislation or administrative management seem necessary. A few political scientists specialize as consultants to college or municipal research bureaus, civic and taxpayers' associations, and government agencies. Some political scientists serve as legislative aids to Congressmen.

Political scientists probably numbered fewer than 10,000 persons in 1956. However, it is exceedingly difficult to estimate the number of persons in this profession, since only those teaching political science in colleges and universities can be clearly identified. The field of applied public administration, in which many political scientists specialize, is very broad and political scientists frequently do work similar to that done by persons with training in many other fields, including business administration, accounting, law, and the other social sciences.

Where Employed

Approximately the same number of professional political scientists are employed by government agencies and by institutions of higher learning. (See chart 29.) Fewer than 10 percent of political scientists are employed by all other types of employers including nonprofit organizations and private industry.

Political science teachers are found in nearly every college community in the United States, since courses in political science and government are widely taught. Since most other political scientists are employed by government agencies, they are likely to be located in Washington, D. C., other large cities, or in State capitals.

Training and Other Qualifications

Graduate training is generally required for professional employment in the field of political science. A master's degree in public administration is generally considered sufficient for political scientists in government service or in nonprofit research and civic organizations concerned with problems of public administration. Completion of the requirements for the Ph. D. degree, except the doctoral dissertation, is the usual prerequisite for appointment to the position of college instructor, and the Ph. D. degree is generally required for advancement to the position of professor.

College graduates with a bachelor's degree in political science find this background sufficient for some entrance-level positions in government and in research organizations. A few find positions which offer training in management or involve research into problems of government administration. Persons in such work may advance to high-level positions and achieve recognized professional status in the field of political science on the basis of experience. Most college graduates with a major in political science who enter government agencies or private organizations are employed as personnel assistants, budget analysts, or investigators, and in other administrative types of work which may also be open to persons with training in business administration, economics, accounting, and many other fields as well as political science.

College graduates with a major in political science frequently continue their education either in political science or in law, since political science is the most common undergraduate major of students planning a law career. More than 100 col-

leges and universities offer graduate training in public administration; a majority of these offer field training, frequently in the form of an internship, which requires the student to perform an administrative assignment in a government organization for a limited period.

Employment Outlook

The rising trend in the employment of political scientists is expected to continue in the late 1950's and throughout the 1960 decade. While most of the increase will be in the college teaching field, a moderate rise is also anticipated in State and local government employment.

Employment opportunities for well-qualified political scientists were good in 1956, with specialists in public administration and public finance most in demand. Rising employment of political science teachers in colleges and universities provided the bulk of the new job opportunities for those with the Ph. D. degree or its near equivalent. The need for better trained personnel in administrative positions in government agencies resulted in an increased demand for political scientists with a master's degree in related fields of specialization. Federal Government agencies concerned with defense activities and foreign affairs were recruiting political scientists with graduate training relating to the problems of certain major geographic areas; a good knowledge of the languages used in the areas was also usually required. Some graduates with the master's degree in political science, as well as a few well-qualified persons with the bachelor's degree, were finding opportunities in research or administrative work in nonprofit agencies working on problems of public administration. A number of political scientists who met certification requirements entered high school teaching.

Employment of political scientists in the college teaching field is expected to rise slowly during the remainder of the 1950 decade and more rapidly during the 1960's. (See statement on college teachers on p. 63.) Employment will probably rise moderately in other fields. Colleges and universities may need an average 300 of new instructors annually to teach new classes and to replace those leaving the college teaching field. A moderate rise in the employment of political scientists trained in public administration is anticipated as a result of the growing stress on the value of specialized and technical training in many areas of government operation, particularly at State and local government levels. Several hundred political scientists, trained in various phases of public administration, will be needed annually to meet expansion and replacement needs in government agencies. No substantial change is foreseen in the employment of political scientists in other types of work.

New Ph. D.'s should find good employment opportunities in college teaching during the late 1950's and throughout the early 1960's, assuming the same proportion of students major in political science as in recent years. Political scientists who have completed all requirements for the Ph. D. except the doctoral dissertation will also find good opportunities to enter college teaching. Those with specialized training in public administration and public finance are likely to find good employment opportunities for professional work in government and civic agencies. Political scientists with master's degrees in other specialties may face considerable competition for professional positions and many will enter other fields of work. New graduates with only the bachelor's degree will probably continue to find professional employment opportunities in the political science field severely limited. However, this background will be most helpful to those planning to continue their studies in law, foreign affairs, journalism, and other related fields.

Information on *Earnings* and *Where To Go for More Information* is given at the beginning of this chapter .

Sociologists

(D. O. T. 0–36.31)

Nature of Work

Sociologists study the many groups which men form—families, tribes, communities, nations, and a great variety of social, religious, professional, business, and other organizations. Sociologists trace the origin and growth of these groups and analyze their activities and the influence they have on their members. Some sociologists are primarily concerned with the characteristics of particular kinds of social groups and institutions; others are more interested in the ways in which individuals

are affected by groups to which they belong. The major specialties in sociology are social organization—including social psychology—and applied sociology which includes human relations in industry, penology and corrections, and regional and community planning. Other specialties are intergroup relations, family problems, social effects of rural and urban life, research methodology, population problems, and public opinion surveys.

College teaching is the principal source of employment for sociologists. However, research is the major function of a growing number of sociologists, including many in college and university research organizations as well as a high proportion of those in the Federal Government and in nonprofit research foundations. Some sociologists are employed in administrative, management, or operational activities, and a few are engaged in consulting work.

Sociological research involves the collection of data—often through personal interviews, the preparation of case studies, administration of tests, carrying out of statistical surveys, and writing of reports. Sociologists may make studies of individuals, families, or communities in an attempt to discover the causes of social problems—such as crime, juvenile delinquency, alcoholism, poverty, and dependency—the sources of family conflict, the normal pattern of family relations, or the different patterns of living in communities of varying types and sizes. They may collect and compile data from official government sources and make statistical analyses to show the trends in population growth and the extent of population movement in different parts of the country. Some sociologists are specialists in survey procedures, in such fields as public opinion research, market research, and mass methods of communication and advertising—including radio, television, newspapers, magazines, and circulars.

Sociologists in administrative work may supervise research projects or the operation of welfare agencies, or marriage and family clinics. Those in operational work may be employed as counselors, recreation workers, case workers, or probation and parole officers. Sociologists engaged in consulting work may give advice on such diverse problems as probation and parole procedures to be used in the treatment of delinquents, city planning, or the most effective methods of advertising to promote public interest in particular products.

Perhaps 5,000 persons were professionally employed as sociologists in 1956. In addition, many persons were employed in positions requiring some training in this field, including many in social, recreation, and public health work. It is exceedingly difficult to estimate exactly the numbers of professional sociologists. Many sociologists outside the teaching field are classified under some other job title. In the Federal Government, for example, sociologists may be designated as social science analysts, public welfare research workers, analytical and survey statisticians, and intelligence research specialists.

Where Employed

Approximately three-fourths of the professional sociologists were employed in colleges and universities in 1956. About one-eighth were in government agencies—Federal, State, local, and international. A few sociologists were employed in research councils and other nonprofit organizations. Not more than 5 percent were employed in private industry or were self-employed.

Sociology is taught in almost all institutions of higher learning. Many of these institutions have social science research organizations which do research on sociological problems. As a result, most sociologists are located in college communities.

Training and Other Qualifications

Undergraduate training in sociology is generally regarded as preliminary to further study in this field or in social work or as preparation for meeting one's personal and social responsibilities rather than as training for professional employment. Nevertheless, a bachelor's degree with a major in sociology is sufficient qualification for some types of jobs in the field of sociology. Persons with such training may be employed as interviewers, or as research assistants working under close supervision. Although it is occasionally possible to advance in such work solely on the basis of experience, graduate training is the usual prerequisite for higher level positions. Sociolgists with bachelor's degrees may also be employed as case workers, counselors, recreation workers, or administrative assistants in public and private welfare agencies. However, the best positions in welfare agencies are commonly reserved for per-

sons with specific training in social work. Those with sufficient training in statistics may obtain positions as beginning statisticians. Those who meet local certification requirements may enter high school teaching. However, a substantial proportion of sociology majors with only a bachelor's degree enter occupations unrelated to their specialized training.

The master's degree in sociology is the usual minimum requirement for appointment to the position of college instructor but, in many of the larger institutions, the completion of all requirements for the Ph. D. degree except the doctoral dissertation is required. Outstanding graduate students may often qualify for teaching assistantships while completing their training for a higher degree.

Sociologists with the master's degree can generally qualify for administrative positions and research-related jobs of somewhat higher level and less routine character than the positions open to those with only the bachelor's degree. They may be given responsibility for conducting specific portions of a survey or preparing analyses and reports under the general direction of an experienced research worker. They are apt to have opportunities for advancement to supervisory work in both public and private agencies.

The Ph. D. degree is essential for attaining a professorship in a high ranking college or university and is commonly required for sociologists who direct major research projects, hold important administrative positions, or act as consultants in government organizations, philanthropic or other welfare agencies, research foundations, marriage and family clinics, and business firms.

Employment Outlook

Employment opportunities for sociologists are expected to increase moderately during the last part of the 1950 decade and substantially during the early 1960's. Most of the demand will continue to be in college teaching; however, research is a growing field for sociologists.

Sociologists with advanced graduate training had better employment opportunities in 1956 than at any time earlier in the decade. State universities and agricultural experiment stations were actively recruiting rural sociologists for staff positions involving research and extension work as well as teaching, owing to increased Federal appropriations for a rural development program. A few sociologists with advanced training in statistics and social psychology were finding new employment opportunities in private industry in the area of market research. The supply of sociologists with advanced training appeared to be sufficient, however, to meet the increased demand. Graduates with no training beyond the minimum required for the master's degree faced keen competition for professional positions as sociologists and many entered related fields such as social work, vocational rehabilitation, and recreation. Most sociologists with only a bachelor's degree entered fields of work unrelated to their major field of study.

Throughout the 1960's, expanding college enrollments and other factors will increase the demand for sociologists. (See statement on college teaching.) Colleges and universities may need as many as 300 new sociology teachers each year, on the average, to meet expansion needs and to replace faculty members who resign, retire, or die. The demand for sociologists trained in research methods, including advanced statistics, will probably continue to increase, although slowly, in the areas of rural sociology, population research, and market research. Some expansion is also expected in connection with studies of acute social problems such as juvenile delinquency, broken homes, and the increasing proportion of old people in the population.

The number of sociologists with the Ph. D. degree will probably rise somewhat more slowly than the demand through the early 1960's, at least (assuming graduations in this field follow the general trend of total graduations). As a result, employment opportunities for both Ph. D.'s and those who have completed all requirements for the doctorate except the dissertation are expected to be good during this period. New graduates with only the master's degree will probably continue to face considerable competition for positions as professional sociologists. Those with specialized training in statistics and survey research methods and some training in population or rural problems or in social psychology are likely to have the best employment opportunities.

Information on *Earnings* and *Where To Go for More Information* is given at the beginning of this chapter.

OTHER PROFESSIONAL AND RELATED OCCUPATIONS

Accountants

(D. O. T. 0–01.)

Nature of Work

Accounting is the second largest field of professional employment for men. In 1956, roughly 350,000 accountants and auditors were engaged in professional accounting work, including some 55,000 certified public accountants (CPA's) who had passed rigorous examinations and met educational and experience requirements prescribed by law in their State. Fewer than 10 percent of all accountants, and 2 percent of the CPA's, were women.

Accountants compile and analyze business records and prepare financial reports, such as profit and loss statements, balance sheets, cost studies, and tax reports. The major fields of employment are public, private, and government accounting. Public accountants provide their services on a fee basis to various business enterprises and the general public. Private accountants, often referred to as industrial or management accountants, handle the financial records of a single business firm and work on a salary basis. Government accountants work on the financial records of government agencies or of private business organizations and individuals whose dealings are subject to government regulation. Accountants in any field of employment may specialize in such areas as auditing, tax work, cost accounting, budgeting and control, or systems and procedures. Public accountants, however, are most likely to specialize in auditing or tax accounting; private accountants, in management or cost accounting. Many accountants in the Federal Government are employed as Internal Revenue agents, investigators, and bank examiners, as well as in regular accounting positions.

Where Employed

The majority of accountants are employed by private industry, with the greatest number in manufacturing establishments. Perhaps a third of all accountants, including a substantial majority of the CPA's, are in public accounting. Federal and State Governments employ nearly one-tenth of the total.

Private accountants are found wherever large business or industrial establishments are located. Public accountants are mainly concentrated in major metropolitan centers, but the proportion in smaller communities is rising because growing numbers are going into business for themselves, and major national firms are continuing to open additional branch offices.

Training and Other Qualifications

Training in accounting is offered in a wide variety of institutions, including 4-year colleges and universities, junior colleges, accounting and other private business schools, and correspondence schools. However, a bachelor's degree with a major in accounting or a closely related field is usually required for the better positions, particularly in public accounting. Four years of college education with 24 semester hours in accounting, or an equivalent combination of education and experience, is required for junior professional positions in the Federal Government. Practical experience is of great value in qualifying for professional accounting work. In 1956, more than 40 colleges offered internship programs in cooperation with public accounting firms, and occasionally with large corporations, which enabled students to obtain several months of experience, thus improving their job opportunities.

In nearly half the States, only those who are licensed or registered may call themselves CPA's or public accountants. Information on registration and certification should be obtained directly from the State Board of Accountancy in the State where the student plans to practice. Most States require at least 2 years of public accounting experience or the equivalent for the CPA license. Although some States have no specific educational requirement, the trend is toward requiring a 4-year college degree with a major in accounting. New York, New Jersey, and Florida require CPA

candidates to be college graduates and similar requirements are pending in several other States. All States use the CPA examination provided by the American Institute of Accountants. An increasingly large proportion of those passing the examination in recent years were college graduates.

Inexperienced accountants usually begin with fairly routine work. Junior public accountants may be assigned to counting cash, verifying additions, or performing other detailed work. They usually advance to semisenior positions in 2 or 3 years and to senior positions within another 2 or 3 years. Those able to deal with top executives in industry may eventually become supervisors, managers, or partners in larger firms. Many become independent practitioners. Beginners in private accounting may start as ledger or cost clerks, timekeepers, junior internal auditors, or, occasionally, as trainees for technical and executive positions. They may rise to chief plant accountant, chief cost accountant, senior internal auditor, or manager of internal auditing, depending on their specialty, and some become controllers, treasurers, and even corporation presidents. In the Federal Government, new accountants are hired as trainees and are usually promoted in a year or less. Although advancement may be rapid for able accountants, particularly in public accounting, those with inadequate training are likely to be assigned to routine jobs with little opportunity for promotion.

Employment Outlook

A shortage of qualified accountants, especially for public accounting and cost work, was evident in 1956. The shortage, most marked in the Midwest and Far West, was due both to a sharp drop in supply (the number of accounting graduates declined by nearly 50 percent between 1950 and 1954) and to a rising demand for accountants to assist management in controlling rapidly expanding business operations. Employment opportunities for accountants in the Federal Government were also greatly increased because of major revisions in accounting procedures.

The demand for accountants is expected to continue to be strong for the remainder of the decade and during the early 1960's. As many as 10,000 accountants may be needed annually during this period to replace those who die, retire, or transfer to other occupations, and at least half as many will be needed each year to fill new positions, unless there should be a major drop in the general level of business activity. Demand for college-trained accountants will rise faster than for less broadly trained personnel, because of the increasing complexity of the accounting profession and because more States are requiring CPA candidates to be college graduates. If the proportion of college graduates majoring in accounting remains the same as in recent years, the numbers receiving degrees in this subject field will rise gradually—from about 8,000 in 1955 to nearly double that number by the midsixties. These graduates are likely to have very good employment opportunities, at least through the early 1960's, and graduates of private business and accounting schools should also have good job prospects during this period. The greatest number of jobs will continue to be in major industrial centers, but there will be many openings in small industrial communities.

Over the long run, accounting employment is expected to expand because of several factors: The greatly intensified emphasis on the use of accounting information for management guidance; the complex tax systems; the growth in size and number of publicly held business corporations accountable to stockholders for their operations; and the increasing use of accounting services by small business organizations. Highly trained accountants will be in even greater demand as consultants on management problems, such as planning of new systems and procedures for use with electronic data-processing equipment.

Increasing numbers of women will be engaged in professional accounting, though most public accounting firms still hesitate to employ them—because of tradition, objections from clients, or because women are considered unsuited for travel or factory assignments. However, those women who rank high among graduates with accounting majors and who secure the CPA certificate will, in time, undoubtedly break down many of these barriers.

Earnings and Working Conditions

Starting salaries for inexperienced professional personnel in New York City public accounting firms averaged about $55 a week in small firms and $60 in medium-size firms early in 1956, according to local placement officials. In general,

salaries were higher in large firms throughout the country. Major CPA firms serving large business corporations were offering from $350 to $400 a month to college graduates with very good academic records and attractive personalities; private business firms of comparable size paid somewhat higher starting salaries. Salaries of senior personnel with 5 years' experience were approximately double the starting rate. Starting salaries tend to be higher in many localities, particularly in the Midwest and the Far West. A survey covering 87 firms actively recruiting college men majoring in accounting, indicated an average monthly starting salary of $352 in 1956.

The Federal Civil Service entrance salary in 1956 was $3,670 for junior accountants and auditors, and $4,525 for those with slightly higher qualifications. Higher level jobs are usually filled by promotion from within.

Since most public accounting work is done in the offices of the firm's clients, physical working conditions may vary from a modern office to an inconvenient, noisy factory. Public accounting work is seasonal and accountants usually work under great pressure during the busy season, from late November to March, and may put in a substantial amount of overtime. Working conditions for private and government accountants are generally the same as for most other office workers, including the standard 40-hour workweek. Auditors in private industry and government and staff members of large public accounting firms may be required to do considerable traveling.

Where To Go for More Information

Information, particularly on CPA's and on the aptitude and achievement tests now given in many high schools and colleges and by many public accounting firms, may be obtained from:

American Institute of Accountants,
270 Madison Ave., New York 16, N. Y.

Further information on specialized fields of accounting may be obtained from the following organizations:

National Association of Cost Accountants,
505 Park Ave., New York 22, N. Y.

Controllers Institute of America,
2 Park Ave., New York 16, N. Y.

The Institute of Internal Auditors,
120 Wall St., New York 5, N. Y.

Information on collegiate training in accounting may be obtained from:

The American Accounting Association,
The College of Commerce and Administration,
Ohio State University, Columbus 10, Ohio

Additional information on employment trends and outlook in accounting is given in the following U. S. Department of Labor publications:

Employment Outlook in Accounting, Bureau of Labor Statistics Bull. 1048, 1951. Superintendent of Documents, Washington 25, D. C. Price 20 cents.

Employment Opportunities for Women in Professional Accounting, Women's Bureau Bull. 258, 1955. Superintendent of Documents, Washington, 25, D. C. Price 20 cents.

Architects

(D. O. T. 0–03.10)

Nature of Work

Architects plan and supervise the construction of buildings and other structures. Their goal is to design structures which are safe, useful, and pleasing to the eye.

When an architect gets a commission for a building, the first thing he does is to confer with the client to determine what his needs are. For example, if a school is to be built, the architect must consider, among other things, the size of the school district and how fast its population is growing; the need for a place to park school buses; the entrances and exits needed in case of fire; the amount of corridor and staircase space required so that students can move quickly from one class to another; and the location, size, and equipment of the lunchroom.

After studying all the requirements of a building, the architect draws up preliminary plans, which are submitted to the client for his approval. Any alterations the client may suggest are incorporated in the final design, which includes the ground and floor plans and vertical cross sections, as well as the exterior of the building. The design is then translated into working drawings, which show the exact dimensions of every part of the structure and where plumbing, heating, and other

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equipment are to be placed. At this stage, consulting structural, mechanical, and heating engineers are called in (except on small jobs where the plumbing and heating contractors provide all the engineering services needed). The engineers' mechanical drawings are then coordinated with the architect's working drawings, and specifications are prepared listing the materials to be used in construction, the equipment, and, in some cases, the furnishings to be installed.

The building is now "off the board," but the architect's responsibility is by no means over. He prepares a list of the building contractors to be invited to bid and receives their sealed bids. He assists the client in deciding which bid to accept and in drawing up the contract between client and contractor. The architect also acts as the client's representative in relation to the contractor, making sure that the design is not altered and that the materials specified in the contract are used in the construction. If problems arise, he may act as arbitrator between client and contractor.

The typical architect is, or expects to be, in practice for himself, either alone or with a partner and a few assistants.

However, large-scale projects, such as the Empire State Building or Radio City, obviously cannot be undertaken by small firms. The increased volume of complex structures, including public buildings, in recent years, has led to the establishment of more large firms, which can be expected to carry out an even higher proportion of all architectural commissions in the future.

As a rule, architects handle a wide variety of projects and do not confine their practice to a particular kind of building.

Moreover, there is relatively little specialization of work along functional lines even within the larger firms. Where there is specialization, it is usually in design, administration, specification writing, and construction supervision. In some middle-size firms and in most large ones, there is more design work than the principals can do themselves, and one or more men are employed as designers. The writing of specifications is another well recognized specialty; some architects even confine their practice to this work, hiring themselves out on a free-lance basis. The architect, or a member of his staff, makes several inspection trips a week to the project under construction. On larger projects, there is also a full-time resident inspector who reports to the architect. Most employees in architectural firms, however, are engaged on the working drawings of the various projects, the scope of their activity and the degree of their responsibility depending on their ability and experience.

Where Employed

As of July 1956, there were 22,554 registered architects. In addition, more than 5,000 people who had not received a license were working as architects.

According to the 1950 Census, only 4 percent of all employed architects were women. An even smaller proportion (less than 1 percent) of all the registered architects that year were women. One of the reasons that more women do not become architects is that the normal path of progress is to enter one's own practice, and women are likely to encounter special obstacles in independent practice.

About half of all architects are self-employed, as individuals or members of a firm of architects. Most of the others are employees of architectural firms. Some architects work for engineers, builders, real-estate firms, and other businesses with large construction programs. Another small group is employed by various government agencies. A few are full-time teachers in schools of architecture.

Members of the profession are found in all parts of the country, mainly in metropolitan areas. In 1955, more than half of the registered architects were in the following seven States: California, Illinois, New Jersey, New York, Ohio, Pennsylvania, and Texas. New York leads all other States in the number of registered architects with 14 percent of the total.

Training and Other Qualifications

A license is required in all States, the District of Columbia, Puerto Rico, Hawaii, and Alaska for the practice of architecture, where safety of life, health, and property is involved. Requirements for admission to the licensing examination vary among States, but generally include graduation from a recognized professional school followed by 3 years of experience. (Most States accept a long period of experience as a substitute for graduation from an architectural school.)

To be accredited as a recognized professional school, a school of architecture must offer at least

a 5-year course, usually leading to the bachelor of architecture degree. The great majority of schools of architecture admit qualified high school graduates, but some require 1 or 2 years of preprofessional education in a college or university.

Entrance requirements vary from one school to another, generally conforming to the standards set for the liberal arts college with which the school or department of architecture is affiliated. Practically all architectural schools emphasize a knowledge of high school mathematics as a condition for entrance, however. Training or facility in both freehand drawing and drafting are important tools for an architect, though not a requirement for entering a course in architecture.

Although a typical curriculum in architecture includes some general subjects—usually English, a physical science, a social science, and some electives—the larger part of the student's time is devoted to professional and technical subjects, including the history of architecture, graphic presentation, building materials and structure, architectural design, specification writing, working drawings, and professional practice.

Success in architecture requires an unusual combination of abilities—not only the capacity to master technical complexities but also a gift for artistic creation and a flair for business and for human relations. It is often recommended that, to gage his interests and potentialities, a young person should, if possible, spend some time in an architect's office before entering architectural school. Architectural students are also encouraged to work in architects' offices or for building contractors during summer vacations. Summer work in an architect's office gives the student some knowledge of practical problems and an advantage over the inexperienced graduate when he looks for his first regular job.

Usually, the new graduate begins as a junior draftsman, entrusted only with display drawings or minor construction or equipment details in the working drawings. As his proficiency increases, he is entrusted with more complex work. After 3 years, he usually graduates to a chief or senior draftsmanship, with responsibility for all the major details of a set of working drawings. If he continues to work for an architectural firm, he will probably progress to a job captaincy, with responsibility for a full set of working drawings and the supervision of other draftsmen. A job captain may also draw up the preliminary plans for a structure. Some men who remain employees in architectural firms become designers rather than job captains, whereas others branch off into specification writing. An employee who is particularly valued by his firm may be designated an associate, and may receive a share of the profits as well as his salary. As noted above, however, the architect's usual goal is to enter his own practice and about half achieve this goal.

Employment Outlook

With construction activity at a high level, the employment situation for architects was very good in 1956, and the outlook for the next decade was considered favorable.

Most architects work on nonresidential projects, such as office buildings, stores, schools, hospitals, clubs, theaters, and government buildings. The demand for architects' services depends primarily on the volume of such construction, although the increasing complexity of modern buildings and homeowners' new awareness of the value of architects' services have meant their somewhat greater utilization in construction. Nonresidential construction, at record levels in 1955 and 1956, is expected to increase much more in the future. The volume of such construction may, by 1965, be more than 50 percent greater and, by 1975, more than 100 percent greater than in 1955. Residential construction, which also employs some architects, is likewise expected to double over the next 20 years. Thus, the demand for architectural services will continue to expand substantially.

These predictions represent the general trends anticipated in the construction industry and the architectural profession over the long run. In the past, long-run trends in the construction industry were interrupted by marked ups and downs. During periods of sharp decline in construction activity, there was serious unemployment among architects and many of them were forced out of the profession. Since World War II, however, the policies of the Federal Government have played a major role in determining the volume of construction, and it is expected that, in the future, the industry and the profession will be more stable than they were before the war.

Besides positions created by the expected increase in demand for architectural services, several hundred openings are likely to arise yearly owing to deaths and retirements. The numbers

of new architectural school graduates available to fill these vacancies and new positions will rise in the late 1950's and the 1960's, assuming that graduations in this field follow the trend anticipated in college graduations as a whole. These new graduates are likely to have good employment opportunities through the early 1960's.

The outlook for women architects is much more uncertain than for men. In 1956, a woman who was a good draftsman could readily obtain employment, and this situation was expected to continue, but chances of advancement are limited for most women architects. Few women achieve an associateship or establish themselves in private practice, although there are and have been some outstanding women architects.

Earnings and Working Conditions

The range of salaries for new graduates of recognized architectural schools was wide in 1956, the amount paid depending on prevailing wages in the particular area, the ability of the candidate as shown by his drawings, and the firm's reputation and ability to pay. New graduates who had worked during the summer while attending architectural school (most students have been able to obtain summer jobs in recent years) commanded a starting rate on their first regular job of from $60 to $90 a week in 1956, based on reports from a few selected employers. Draftsmen with 3 or more years' experience had salaries ranging up to $150 a week; job captains, specification writers, and other senior employees earned up to $200 a week.

Some architects in private practice earn a good deal more than high-paid salaried employees of architectural firms. But the range of incomes is very wide. In 1950, for example, some independent architects earned less than $3,000 a year while others had professional incomes of $25,000 or more. Undoubtedly some of those with low incomes had not been long in private practice. The young architect who starts his own office often goes through a period when his expenses are greater than his income. The need for a financial reserve in the initial period of practice and the wide range of earnings are characteristics of all self-employed professional groups.

Where To Go for More Information

American Institute of Architects,
1735 New York Ave. NW., Washington 6, D. C.

Commercial Artists

(D. O. T. 0–44.)

Nature of Work

Commercial artists design and draw illustrations for advertisements, books, magazines, posters, displays, and television commercials. In addition, they may retouch photographic prints, prepare charts and maps, draw movie cartoons, do freehand and mechanical lettering, design labels for containers, and sketch and color greeting cards. In contrast to painters and others engaged in the fine arts who have a free choice of subject matter and method of presentation, the commercial artist does work to fit the requirements of a specific client or employer. Of the approximately 80,000 artists and art teachers employed in 1950, it is estimated that the majority were commercial artists.

Commercial art work requires skills ranging from creative planning, designing, and drawing to relatively mechanical operations. Many artists specialize in a particular technique or type of commercial art. Among the most important specialists are layout men who choose and arrange the positions of pictures and lettering so as to attract the eye; illustrators who are primarily concerned with making the sketches and drawings; and letterers who design and execute the appropriate lettering, either freehand or with the use of mechanical aids.

Where Employed

The largest employers of commercial artists are advertising agencies, commercial art studios, printing and publishing companies, television and motion picture studios, and department stores. A number work for Federal Government agencies, principally the Departments of the Army, Navy, and Air Force. Others fill positions in sign shops, mail-order houses, calendar and greeting card companies, and a variety of other business establishments. A few commercial artists teach in art

Commercial artist preparing copy for newspaper ad.

schools. Many are free-lance artists who work independently on specific assignments and generally sell their services to several different employers. Some commercial artists who hold salaried positions also do free-lance work.

Most commercial artists are employed in big cities, such as New York, Chicago, Philadelphia, Los Angeles, and Detroit where the largest users of commercial art are located.

Training and Other Qualifications

Artistic ability is the most important qualification needed to become a commercial artist. In addition, a considerable amount of training in the techniques of commercial art is required. This may be obtained in art schools, in commercial art courses offered by public vocational high schools, and through practical experience on the job. Training in the fine arts is not generally considered appropriate preparation for employment as a commercial artist.

The most widely accepted training for commercial artists is that given in art schools or institutes which specialize in teaching commercial and applied art. To enter art school, a high school education is usually, but not always, required. Some schools admit only those applicants who demonstrate talent by submitting acceptable work samples. The course of study generally takes 2 or 3 years and a certificate is awarded on graduation. However, a growing number of art schools, particularly those connected with universities, require 4 years of study and confer a bachelor's degree—commonly the bachelor of fine arts (B. F. A.) degree. In these schools, commercial art instruction is supplemented by cultural subjects such as English and history.

The first year in art school may be devoted to the study of such fundamentals as perspective, design, color harmony, composition, and use of crayon, pencil, pen and ink, and other artistic mediums. Subsequent study generally includes drawing from life, advertising layout, lettering, typography, illustration, and highly specialized courses in the student's particular field of interest.

Good drawing technique, creative imagination, and artistic judgment concerning the harmony of color and line are basic requirements for a successful career in commercial art. The various specialties, however, differ in some of the specific abilities required. For example, letterers and retouchers must be able to do precise and detailed work requiring excellent coordination, whereas the qualifications most needed by illustrators are that they be highly imaginative and able to draw well. For commercial artists engaged in free-lance work, the ability to sell both ideas and finished work to employers or clients is very important.

Beginning commercial artists need on-the-job training before they are judged to be qualified for more than very routine jobs. These artists are generally assigned to work such as erasing smudges from art work, filling in colors on experienced artists' drawings, and doing pasteup work (using scissors and a pot of paste to assemble the components of an advertisement or other art work). In this field, advancement is based largely on the individual's artistic talent and creative ability. Those with the necessary qualities can become layout men, letterers, illustrators, or other specialists. After a few years of experience, some commercial artists leave salaried employment for free-lance work.

Employment Outlook

Talented young artists who were trained at good schools found employment opportunities very favorable in late 1956. Less well-trained begin-

ners who could demonstrate talent were, as a rule, able to obtain employment readily. As in the past, many young people who lacked sufficient talent or training were seeking to enter the field, and these faced keen competition. Commercial artists with specialized skills—particularly in lettering, layout, pasteup, and typography—were in greater demand than those with only general training. However, employment opportunities for beginning illustrators were limited since, in this specialty, experienced free-lance artists are used extensively.

In the late 1950's and early 1960's, employment and advancement opportunities are expected to continue to be good for talented and well-trained entrants. Some young people with only average ability will also probably be able to enter the field, but they will have very limited chances for advancement. A number of new job openings will arise as a result of the anticipated expansion of the field. In addition, young commercial artists will be needed to replace those who die, retire, or transfer to other types of work. Most opportunities for employment will continue to be in the large cities which serve as the commercial art centers of the country.

A gradual increase in employment of commercial artists is expected over the long run. The upward trend in business expenditures for all kinds of visual advertising will be reflected in a growing demand for commercial artists; the television industry and packaging design are expected to offer expanding areas of employment; and other forms of art such as poster and window displays, greeting cards, calendars, and movie cartoons will also probably employ an increasing number of artists. In addition, the growing field of industrial design is expected to need more artists who are qualified to work with engineering concepts. On the other hand, greater use of photography may continue to affect adversely the demand for illustrators, although those with contemporary styles may still do well as magazine fiction illustrators. It should also be borne in mind that a major economic recession would decrease overall employment opportunities by reducing advertising budgets.

Women with exceptional artistic talent will continue to find employment in all aspects of commercial art work, but opportunities will probably remain limited for most women commercial artists. Work as fashion illustrators in department stores is the major source of employment open to women artists. However, some do free-lance work, and others hold positions with printing and publishing houses, greeting card companies, advertising agencies, commercial art studios, and government agencies.

Earnings and Working Conditions

Inexperienced commercial artists earned, on the average, between $40 and $60 a week in 1956 although some started at higher salaries. The amount earned varies with the beginner's talent as revealed by his portfolio of samples, his training, the particular job, the type of firm, and geographic location. After a few years of experience, qualified artists may expect to earn about $100 a week. Art directors, designers, executives, well-known free-lance illustrators, and others in top positions generally have much higher earnings.

A 1955 survey (made by Art Direction magazine) of 2,500 art directors and other commercial artists in top positions showed that about 75 percent earned between $5,000 and $15,000 annually. More than 20 percent made $15,000 or more annually, and fewer than 5 percent earned less than $5,000 a year. Earnings were higher in New York City than in any of the other 20 cities included in the survey; the median (average) salary was between $15,000 and $20,000 yearly in New York. In Chicago, Cleveland, Detroit, Los Angeles, Miami, Minneapolis, and Philadelphia, the median salaries were between $10,000 and $15,000 annually. Nearly 1 out of every 3 salaried persons surveyed also did free-lance work.

Salaried commercial artists generally work 35 to 40 hours a week, but sometimes must work long hours under a considerable amount of pressure in order to meet deadlines. Free-lance artists usually have irregular working hours.

Where To Go for More Information

Information on schools, employment trends, and earnings is available from:

National Society of Art Directors,
115 East 40th St., New York, N. Y.

Dietitians*

(D. O. T. 0–39.93)

Nature of Work

Dietitians plan adequate diets and menus to help people maintain or recover good health. They may also help educate people regarding good food habits.

Administrative dietitians administer and direct food service programs for large public and private institutions. They arrange for the purchase of food and supplies and supervise the maintenance of sanitary conditions in kitchens and pantries. They are also responsible for the selection and training of employees who work with food. They may help the director of a dietetic department formulate departmental policy, coordinate dietary service with activities of other departments, and assist with the management of the budget.

Therapeutic dietitians are directly responsible for nutritional service to patients. They confer with doctors and nurses about the patients' nutritional problems, visit patients to explain their individual food needs, and help them maintain diets prescribed by the physician. Therapeutic dietitians may work in hospital clinics for outpatients—often with the title of *clinic dietitian*. In the clinics, they discuss diet problems with individual patients or with groups of patients, such as diabetics, to help them follow physicians' orders. They may also demonstrate how food is prepared.

Some dietitians continue their training in graduate classes and become *public health nutritionists*. The work of the public health nutritionist is principally that of technical consultation and in-service education for health, welfare, and education personnel who come into direct contact with the public. A State public health nutritionist, for example, may visit State hospitals and sanatoriums throughout the State and consult with the personnel in charge of food service on the adequacy of the inmates' diets, sanitation practices, and kitchen layouts. They may hold community conferences with members of various local health units to improve public understanding of the nutritional use of food. They may speak or advise on nutrition at meetings of such groups as dentists, nurses, health officers, and camp leaders. They

The hospital dietitian is responsible for planning nutritional and attractive meals for patients of all ages.

may work for the prevention of dietary deficiency diseases in a region or determine the extent of malnutrition in a community.

Where Employed

More than 22,000 persons were employed as dietitians and nutritionists in 1950, according to the census. All but a small percent of them were women.

The largest number of dietitians work in hospitals. The American Hospital Association reported over 9,700 dietitians employed in hospitals in 1955. Nearly 9 percent of them were working part time. General and special hospitals (except psychiatric and tuberculosis) employed 8,600 dietitians; psychiatric hospitals, 700; and tuberculosis hospitals, 400.

Many dietitians work in institutions for the aged, in correctional institutions, and summer camps for children. Some supervise school-lunch programs or food service in schools, on transportation lines, or in commercial and industrial establishments. Others work as consultants for Federal, State, and local governments to assist less experienced personnel with problems of ad-

*Prepared by the Women's Bureau, U. S. Department of Labor.

ministration and operation of food service programs. A few are self-employed and work as consultants, serving private patients in conjunction with a physician or group of physicians.

Most public health nutritionists work for Federal, State, and local health departments. Over 400 public health nutritionists were employed in 1955. Approximately 275 of these were in State and local health agencies and the remainder were in the Federal Government and voluntary health and welfare agencies. A few are employed abroad as advisors to foreign governments.

Training, Other Qualifications, and Advancement

To qualify as a professionally trained dietitian, it is necessary to complete a 4-year course in the home economics department of an accredited college or university and obtain a bachelor's degree. The course must include a specialty in foods and nutrition with related courses in the physical and social sciences, such as chemistry, psychology, and sociology. Those who expect to become administrative dietitians should also take courses in institutional management.

After obtaining a bachelor's degree, many graduates spend a year as dietetic interns in 1 of the 65 hospitals or training centers approved by the American Dietetic Association. The intern is usually provided room, board, and professional laundry without cost, and may also receive a small monetary stipend. United States Government hospitals pay $2,000 for the year of internship, but the intern reimburses the Government for room and board. Completion of an approved internship is accepted by many employers as evidence of adequate training, and preference is given job applicants who have this training. Completion of an internship or 3 years of experience, 1 year of which has been supervised by a member of the Association, makes a dietitian eligible for membership in the American Dietetic Association.

Dietitians planning to become public health nutritionists take graduate courses in public health nutrition in 1 of about 15 colleges or universities offering such advanced training. These courses lead to the degree of Master of Science with a major in nutrition.

Some junior colleges or vocational schools offer 2 to 3 years of training in dietetics. This training, however, does not qualify persons for professional-status jobs. Such individuals may be employed as dietetic aids or sandwich girls or may have charge of the food service in some small institutions.

Good advancement opportunities exist for the experienced dietitian and nutritionist. After a few years' experience in a small hospital or as an assistant on the staff of a larger institution, a dietitian may be promoted to a chief dietitian's job. Nutritionists may advance to such posts as nutrition consultant or director of nutrition services in a State or local public health department or voluntary health and welfare organization. Dietitians who prefer to work in the educational field and who meet the requirements, may find good opportunities as home economics teachers in high schools and colleges, or schools of nursing. (See index for reference to statements on home economists and on secondary school and college teachers in this Handbook.)

Employment Outlook

The supply of qualified dietitians and public health nutritionists has not kept up with the demand, the shortages being most marked in the East and Midwest. Not enough qualified persons are entering the profession to provide replacements for those who leave and to fill new positions resulting from expansion in employment in the food service and nutrition fields. In the 5-year period from 1950 to 1955, an average of 1,000 new positions were created annually in hospitals. This increase alone exceeded the number of newly trained dietitians who became available each year. In 1955–56, only 674 dietetic interns were in training; 173 internships remained unfilled.

The shortage of trained dietitians and nutritionists is expected to continue well into the 1960's. The expansion of hospital programs, school-lunch programs, and programs in expanding facilities for the aged point to an increasing need for fully trained dietitians.

Earnings and Working Conditions

Salaries offered in mid-1955 ranged from $3,420 to $4,560 yearly for inexperienced staff dietitians who had completed their internships, and from $3,540 to $5,520 for dietitians with 4 to 5 years of experience, according to the placement service of the American Dietetic Association.

In 1955, dietitians in very large nonfederal hospitals were reported to receive as much as $10,000 a year. In 1956, beginners in Federal hospitals received an annual salary of $3,670. Qualified persons with 1 year of experience could receive a starting annual salary of $4,525. Annual salaries for dietitians in the Federal service range up to $7,465.

A survey of hospital personnel, made by the Bureau of Labor Statistics, showed that in 14 metropolitan areas surveyed in 1956 and 1957, average weekly salaries of hospital dietitians ranged from $68.50 in Atlanta to $84.50 in Chicago. Most of these dietitians worked an average of 40 hours per week. The average straight-time weekly earnings and hours of hospital dietitians in the survey areas follow:

City	Weekly average	
	Hours	Earnings
Atlanta	42.5	$68.50
Baltimore	40.5	76.50
Boston	40.5	72.00
Buffalo	41.5	70.00
Chicago	40.5	84.50
Cincinnati	40.0	78.50
Cleveland	40.0	80.50
Dallas	40.0	73.50
Los Angeles–Long Beach	40.0	78.50
Memphis	41.5	75.00
Philadelphia	40.5	69.50
Portland (Oreg.)	40.0	79.00
San Francisco–Oakland	40.0	81.00
St. Louis	40.5	73.50

Where To Go for More Information

The U. S. Civil Service Commission, Washington 25, D. C., has information on the requirements for dietetic interns and dietitians in Federal Government hospitals. (See also chapter on Government Occupations. Refer to index for page numbers.)

Further information on employment opportunities is contained in the following publication:

The Outlook for Women in Dietetics, Bulletin No. 234–1, U. S. Department of Labor, Women's Bureau, available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price 25 cents.

A list of accredited colleges, universities, and internship centers, and information on scholarships and employment can be obtained from:

American Dietetic Association,
620 North Michigan Ave., Chicago 11, Ill.

American Home Economics Association,
1600 20th St., NW., Washington, D. C.

Draftsmen

(D. O. T. 0–48.)

Nature of Work

In making an airplane, a house, a ship, or almost any other product, manufacturers and construction companies need detailed plans giving dimensions and specifications for the entire product and each of its parts. The workers who draw these plans are draftsmen. They translate the ideas and calculations of engineers into exact drawings and sketches, using such instruments as compasses, dividers, scales, T-squares, protractors, and triangles. In many companies, draftsmen are supplied with drafting machines which combine several of these measuring and guiding devices, making preparation of drawings faster and easier.

Draftsmen in higher grade positions, such as that of design draftsman, generally work from sketches, specifications, or field notes furnished by an engineer, architect, or designer. They have the important job of transforming ideas into actual drawings generally called layouts. Their work may include making calculations concerning the strength, quality, and cost of materials; such calculations may require the use of engineering handbooks and tables. In many drafting rooms, draftsmen known as detailers are responsible for making working drawings of details or parts of the machine or article to be manufactured. Detailers usually work from layouts prepared by design draftsmen. Other draftsmen designated as checkers examine each drawing for errors. Tracers may also be employed to make corrections and to prepare the drawings for blueprinting by copying them in ink on transparent cloth sheets, although, in recent years, photoreproduction of final pencil drawings has been rapidly eliminating the need for tracing in ink. Tracers' work is mostly routine and requires relatively little knowledge or skill.

Practically all draftsmen specialize in some particular field of work. The largest fields are mechanical, electrical, aeronautical, structural, architectural, naval architectural, and topographical drafting.

Where Employed

Drafting is a large occupation, employing about 125,000 persons in 1950, of whom about 7 percent were women. The occupation has grown considerably since that time.

The industries which employ the most draftsmen include construction and the following branches of manufacturing: Machinery, electrical equipment, aircraft, motor vehicles, chemical products, and fabricated metal products. Many draftsmen work for engineering and architectural consulting firms, and sizable numbers are employed by Federal, State, and local governments. Although some are employed in every State and in small as well as large cities, the greatest number of draftsmen work in the Northeastern, Middle Atlantic, and North Central States.

Training and Other Qualifications

A person can acquire the specialized training needed to become a draftsman from a number of sources, including technical institutes, junior colleges, extension divisions of universities, colleges offering special 2-year programs, technical high schools, correspondence schools, and trade schools. A person can also become a draftsman by serving a 3- or 4-year apprenticeship or by some other type of on-the-job training combined with part-time schooling. In any case, the training should include mathematics, physical sciences, mechanical drawing, standard methods of lettering, and tracing. Many of the higher grade jobs require a knowledge of the industry involved.

Persons with little or no training begin their drafting careers as trainees (sometimes called tracers) or apprentices and later advance to junior draftsmen. Those with specialized training can usually start directly in junior drafting positions. From such positions, advancement is possible to senior draftsman, and then to design draftsman. Some workers eventually advance to chief or leader draftsman. From top drafting jobs, it is possible to advance to design and engineering positions, especially if additional training in mathematics and science is obtained. Many graduates of engineering and architectural schools start their careers in the drafting rooms but usually advance rapidly into professional positions.

Many agencies of the Federal and State Governments hire trainees and apprentices in addition to experienced draftsmen. As in industrial organizations, workers in government employment advance as they gain in skill and experience.

A person desirous of a drafting career should have an aptitude for detail and for visualizing objects; artistic ability is not generally required. Good eyesight is important, since drafting involves close work.

Employment Outlook

Employment opportunities for well-trained draftsmen were excellent in 1956. Job prospects for persons wishing to begin a drafting career as an apprentice or trainee were also very good. The demand for draftsmen increased rapidly after the outbreak of hostilities in Korea in 1950, when the needs of the defense program were added to those of an expanding civilian economy. During the middle 1950's, not enough trained draftsmen were available to meet the growing demand, and many employers reported difficulty in filling jobs.

Employment of draftsmen will probably continue to increase both in the near future and over the long run. As the engineering and scientific occupations grow, more draftsmen will be required as supporting personnel. Moreover, the industries employing most draftsmen are expected to expand further; and with the increasing complexity of industrial operations, design problems will become more and more involved, adding to the need for well-trained draftsmen. In addition to draftsmen needed to fill new positions, many will be required each year to replace those who die, retire, or move into other fields. Losses to the occupation from death and retirements alone were estimated to be about 1,600 during 1956 and will rise slowly in the future.

This analysis assumes a continued high level of employment and business activity in the country as a whole. It also assumes that Government spending for defense—a major factor affecting demand for draftsmen—will remain high. A substantial cut in defense spending or a sharp drop in business activity in the metalworking or con-

struction industries would reduce the demand for draftsmen. On the other hand, a substantial increase in defense expenditures or an acceleration in other government programs such as public works would intensify the demand for draftsmen.

Earnings

Average straight-time weekly earnings of draftsmen in 17 cities in the winter of 1955–56 were as follows:

Area	Draftsmen			
	Tracer	Junior	Senior	Chief or leader
Northeast:				
Newark–Jersey City	$58.00	$71.50	$100.00	$129.50
New York City	------	72.00	108.50	144.50
Philadelphia	------	73.00	97.50	132.50
Providence	------	62.00	85.00	113.00
South:				
Atlanta	----	69.50	96.00	138.50
Dallas	52.50	63.50	84.50	107.50
Memphis	------	67.50	99.50	-------
New Orleans	------	69.50	94.50	-------
Middle West:				
Chicago	63.00	78.00	106.00	130.50
Detroit	71.50	90.00	120.50	-------
Milwaukee	------	78.00	98.50	------
Minneapolis–St. Paul	62.50	75.50	93.50	------
St. Louis	------	79.50	106.00	-------
Far West:				
Denver	------	84.50	104.00	129.50
Los Angeles–Long Beach	------	80.50	98.50	130.50
Portland	------	79.50	97.50	118.00
San Francisco–Oakland	------	77.00	94.50	118.50

NOTE: Tabulation includes male draftsmen only. Dashes indicate insufficient data to warrant presentation.

In early 1957, indications were that draftsmen's salaries in most cities and for most skill levels were at a higher level than those shown in the tabulation.

In the Federal Civil Service, the entrance salary for trainee draftsmen who were high school graduates without experience was $2,960 in 1956. For those with post-high school education and training in drafting, entrance salaries were higher. The majority of experienced draftsmen working for the Federal Government earned between $3,670 and $4,525 in 1956, and some earned still higher salaries.

Where To Go for More Information

General information on drafting careers may be obtained from:

American Federation of Technical Engineers,
900 F St. NW., Washington 4, D. C.

The American Institute of Architects,
1735 New York Ave. NW., Washington 6, D. C.

Information on training opportunities may be obtained from:

Engineers Council for Professional Development,
29 West 39th St., New York 18, N. Y.

National Home Study Council,
1420 New York Ave. NW., Washington 5, D. C.

National Council of Technical Schools,
1507 M St. NW., Washington 5, D. C.

The U. S. Civil Service Commission, Washington 25, D. C., will furnish information on positions available in Federal Government agencies. For further information on such positions and how to apply for them, see chapter on Government Occupations.

Foresters

(D. O. T. 0–35.07)

Nature of Work

Foresters are concerned with growing and managing forests and utilizing their resources. The forest-land manager is responsible for all the resources and activities in his area, including recreational facilities, wildlife, and grazing land, as well as timber. One part of his job is to protect valuable lands from fire, destructive insects, and disease. Other important duties include estimating the amount of timber in a forest area, appraising the value of forest lands, selling or buying timber, and planning and supervising the cutting of timber so that mature trees are removed and younger ones left for future logging operations. Professional foresters regard trees as a crop which should be harvested in such a manner that the amount of timber cut will not exceed the new growth.

Because the work of the forester covers such a wide range of activities, numerous specialties have developed. Wood utilization, for example, begins with the logging of timber and also includes the

COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

The forest-land manager is responsible for all the resources and activities in his area. This district ranger and grazing permit holder are inspecting range conditions in one of the national forests.

various industrial phases of converting wood into consumer products. Other specialties include wildlife management, range management, forest economics, and recreation work. Some of these specialties are rapidly becoming recognized as distinct professions. Foresters may also specialize in such activities as research, editing and writing, extension work (educational work regarding scientific forestry practice among farmers, logging companies, and the public), and teaching at the university level.

Where Employed

Roughly 17,000 professional foresters were employed in forestry and closely allied fields in 1956, according to estimates made by the Society of American Foresters. The largest group, nearly 7,400, were in private industry, working mainly for lumber, pulp and paper, and veneer and plywood companies, though some were in business for themselves as consultants or managers of their own land. Although the number of consultants is small, this field represents a growing source of employment for professional foresters.

Nearly as many foresters were in government as in private employment. About 5,000 worked for the Federal Government, mainly in the Forest Service of the U. S. Department of Agriculture. Some were employed by the Department of the Interior, the Tennessee Valley Authority, and a few by the Department of Defense and other Federal agencies. In addition, about 1,800 worked for State Governments and about 250 for county and municipal governments.

College teaching and other educational activities, including extension work and university research, provided employment for approximately 750 foresters. The remaining 1,800 held a variety of jobs. This group included specialists in such closely allied fields as wildlife, range management, tree culture, forest engineering, and watershed management.

Training and Other Qualifications

Four years of college work leading to a bachelor's degree in forestry is usually the minimum educational requirement for entrance into the profession. Students are almost always required to spend one summer in summer camps operated by their college. They are also encouraged to gain first-hand experience in forest or conservation work during other summers.

Training in forestry leading to a bachelor's or higher degree was offered in 1956 by 37 schools, 26 of which were accredited by the Society of American Foresters. The curriculum in most of these schools included a foundation of essential courses in five areas: (1) silviculture (methods of growing and improving forest crops); (2) forest protection (from fire, insects, and disease); (3) forest management (which includes the study of mensuration or measurement of the amount, condition, and types of timber and timber products, surveying, and mathematics through trigonometry); (4) forest economics; and (5) forest utilization (the harvesting and marketing of timber and other forest resources).

Most schools offer an additional year's training leading to the master's degree and some offer doctoral training. Although graduate training is not essential for entrance into the profession, the master's degree is generally required for teaching or research positions and the doctorate is highly desirable for such posts.

Some foresters have entered the profession with training primarily in a related field such as horticulture, botany, or agronomy. Also, specialists in forest engineering have entered with engineering degrees and wood technologists with degrees in chemistry, physics, or engineering.

In addition to adequate training, qualifications for success in the field of forestry include sufficient physical stamina to perform the many arduous tasks required and a willingness to work much of the time in isolated areas. Since many forestry jobs also involve public contacts, the forester must have facility in dealing with people.

Employment Outlook

Employment opportunities for forestry graduates were good in 1956 and are expected to remain favorable throughout the 1950's. The demand for foresters has risen rapidly since the end of World War II, principally as a result of large-scale application of scientific management to forest lands owned by private industry. Growth of allied fields—such as wildlife management, wood utilization, recreation, and range management—has also provided many new positions. On the other hand, the number of forestry graduates declined sharply during this period, from the record high of 2,394 in 1950 to 852 in 1955, the lowest level since the years immediately following World War II. A steady increase in the number of forestry degrees granted is expected after 1955, however, along with the anticipated continued growth in employment opportunities. As in recent years, there will probably be particular need for well-qualified personnel with advanced degrees for research positions.

The long-run outlook is for continued expansion of employment in forestry. The country's growing population and rising living standards well tend to increase the demand for lumber, paper, and other major forest products, although the demand for these products will also be influenced by any changes in the general level of business activity affecting construction and other major wood using industries. Recent trends emphasizing scientific forestry practice are expected to continue. Companies in the forest product industries are becoming increasingly aware of the profitability of improved forestry and logging practices and new technical developments for utilizing the entire forest crop. Moreover, further advances in research and in wood utilization and technology are needed to reduce costs and develop new and improved products, especially in view of the constant competition from products made of metals, plastics, and other materials.

The extent of employment opportunities for foresters will also depend on whether or not a shortage of timber develops in this country. Assuming continuation of present trends in forest management, most authorities believe that growth of timber during the next 20 years will be sufficient to meet the expected increase in demand for wood. If during this period the demand for timber should rise much more than anticipated, scientific forestry practice would undoubtedly be extended and intensified. For example, one of the largest potential sources of future employment opportunities for foresters is the 4.5 million small owners of forest land, whose holdings comprise more than half the Nation's commercial timberland. At present, only a small fraction of these lands are under professional forestry management. If demand for timber increases enough so that these small owners find it profitable to utilize foresters' services, additional job opportunities will become available.

Employment of foresters in the Federal Government has grown steadily during the past decade and it is expected that the growth will continue for a number of years. In early 1957, the Forest Service of the U. S. Department of Agriculture anticipated that their future demand for foresters would grow at an even more rapid rate than in the past. Among the major factors which are expected to affect this growth are the growing volume of timber cut on Federal lands, and the trend toward more scientific management of these lands. Of course, funds necessary for the intensification of scientific management on Federal lands are subject to congressional approval.

State Government agencies also will probably continue to expand their employment of foresters. Forest fire control and other Federal-State cooperative programs such as providing technical advice to owners of private forest lands, are being channeled more and more through State organizations. Growing demands for recreation facilities in forest lands are likely to result in expansion of State parks and other recreation areas.

In addition to openings created by the growing need for professional foresters, some vacancies will occur as a result of deaths and retirements. However, such openings will not be numerous during the 1950's and 1960's, since foresters are a relatively young group.

Along with the expected growth of employment in the profession, a rise in the number of forestry graduates is likely to occur, especially after 1960. If young men with degrees in forestry continue to represent the same proportion of all college graduates as in recent years, the number of bachelor's degrees granted each year in forestry will, by the middle 1960's, be almost twice the 1955 figure and, by 1970, will be about as high as in the peak year 1950. Graduating classes of this size may likely encounter competition for the better paying professional entry jobs in forestry, unless scientific management of forests expands faster than is indicated by present trends.

Opportunities for women in the profession of forestry are and probably will continue to be, few—largely because of the necessary field work, much of which is rigorous and in isolated places.

Earnings and Working Conditions

Starting salaries for new forestry graduates with bachelor's degrees were often between $3,600 and $4,500 in private industry in 1956, according to the Society of American Foresters. In more responsible jobs, such as managing a company forest, salaries were typically $7,500 to $9,000. Foresters holding executive positions in land management or wood procurement were reported to earn from $10,000 to $15,000, and those who were officers of corporations usually received from $15,000 upward. In addition to their salaries, foresters in private industry may be furnished nonmonetary benefits such as rent-free houses, fuel, and the use of company transportation.

In the Federal Government, the beginning salary of foresters with only the bachelor's degree was $3,760 per year in 1956. Those with a master's degree could begin at $4,525 and those with a doctor's degree at $5,440 if employed in research work. In late 1956, Federal starting salaries for forestry graduates with bachelor's degrees were raised to $4,210 and for those with master's degrees to $4,930 per year. Beginning salaries for forestry graduates with doctoral degrees remained at $5,440 per year. In addition, the salary schedule provides for periodic increases above these base salaries. Individuals in administrative and supervisory positions received higher salaries. For example, in the Forest Service, forest rangers in charge of a district earned from $5,440 to $7,465, annually. Supervisors of national forests received from $7,570 to $10,065, and regional foresters who administered a number of national forests as well as cooperative activities with States and private landowners received from $11,610 to $12,690 a year. When living quarters are furnished, a salary deduction is made. The amount varies with the value and kind of accommodations but was usually from $200 to $600 per year in 1956.

Salaries for foresters employed by the States have been generally somewhat lower than those paid by the Federal Government. In recent years, however, salaries paid by many State Governments have increased so that they are now close to those paid in Federal employment.

Salaries in teaching and research in a college or university depend upon the institutiton and the position held. In the 26 schools of forestry accredited by the Society of American Foresters, 1956 salaries average about $3,000 for beginning instructors and ranged from $5,000 to $12,000 for professors. Heads of departments or schools earn between $6,500 and $14,000 a year.

As part of his regular duties, the forester must spend considerable time out of doors under all kinds of weather conditions. Many foresters put in extra hours in travel and in emergency duty such as firefighting. Travel often involves absence from home for extended periods of time, particularly in beginning jobs. The young forester is also likely to have his headquarters shifted frequently. With advancement to more responsible positions, he can expect a more permanent assignment.

The hazardous nature of many forestry jobs is indicated by the fact that insurance companies often require extra premiums for forest rangers and others whose duties involve working alone in remote areas. Foresters working in logging and sawmilling may also face accident hazards. Although injury rates in these industries have been reduced, they are still far above the average for manufacturing industries.

Where To Go for More Information

Additional information on the profession of forestry and on accredited schools may be obtained from:

Society of American Foresters,
825 Mills Bldg., 17th and Pennsylvania Ave. NW.
Washington 6, D. C.

Forest Service, U. S. Department of Agriculture, Washington 25, D. C.

American Forest Products Industries, Inc., 1816 N St. NW., Washington 6, D. C.

Additional information on career opportunities in forestry and on schools providing instruction is given in the following Government publications:

U. S. Department of Agriculture, Careers in Forestry. Miscellaneous Publication No. 249, 1955. Superintendent of Documents, Washington 25, D. C. Price 15 cents.

Forest Service, U. S. Department of Agriculture, Forestry Schools in the United States, 1951. U. S. Department of Agriculture, Forest Service, Washington 25, D. C. Free.

Home Economists*

(D. O. T. 0–12.10 through 0–12.36)

Nature of the Work and Where Employed

Home economists are employed in a wide variety of specialized occupations. At least half of the approximately 70,000 home economists in the country work for Federal, State, or local government agencies as home economics teachers, extension service workers, dietitians or nutritionists, and research workers. They work in secondary schools and colleges, hospitals and other institutions, and in government agencies which provide services directly to the public. Other home economists work mainly for private schools and hospitals, commercial or industrial eating establishments, for business and manufacturing firms, and for newspapers, magazines, and radio and television broadcasting companies.

Although home economics is generally considered a woman's field, a growing number of men are entering various home economics professions. Some men are employed in teaching, merchandising, interior design, and family counseling, but most of them specialize in foods and institution management. In 1955, nearly 500 men were majoring in home economics (about 1 percent of the number of women home economics majors).

The largest group of home economists (about 42,000) are teachers, of whom about 27,000 are employed in the public schools; about 500 in private and parochial schools; approximately 3,000 in colleges and universities; and 11,000 in adult education programs. (For information on teaching, see statements on secondary-school teachers and college and university teachers in this Handbook. Refer to index for page numbers.) An additional 5,000 are employed as *extension service workers* (see chapter on Professional and Other Agricultural Occupations). More than 20,000 are employed as *dietitians* (see statement on dietitians).

*Prepared by the Women's Bureau, U. S. Department of Labor.

Another group of 3,500 specialists are *home economists in business.* They are employed in commercial establishments which manufacture or distribute products or services used in the home, or are associated with magazines, newspapers, radio, and television.

More than a thousand of this group of specialists are known as home-service workers and are employed by *gas or electric utility companies;* another 400, known as equipment workers, are employed by *manufacturers* of household equipment, such as washing machines, kitchen cabinets, or cooking utensils. They demonstrate the use of the company's equipment in the customer's home and advise on the effective use of fuel. They may address groups of retailers, homemakers, or young people, prepare newspaper articles or booklets, or make personal appearances on radio or television programs.

Home economists in *food manufacturing*, numbering about 1,000, interpret the needs of consumers to food manufacturers and prepare recipes and other material for consumers. They may test and develop new products, improve present products, write cookbooks or directions on food packages, and answer consumers' queries.

About 450 others are employed in *journalism, radio, and television.* They write articles and feature stories on foods, clothing, and other topics of household interest. Some home economists in radio and television personally present their educational programs.

Possibly 250 additional specialists have various types of work in the *advertising* and *public relations* fields with companies producing or distributing all types of homefurnishings, household supplies, and services.

The field of *textiles and clothing* employs more than 100 home economists who advise on fibers and

fabrics available for clothing and household furnishings and their economical and functional use. Some of these specialists are employed in research. Others are employed as advisers by dress-pattern companies, clothing manufacturers, laundry and dry-cleaning establishments, and a few chain clothing stores for which they write news stories and booklets, plan educational and promotional programs, and engage in other public-relations work. In addition to these experts, other home economists with a knowledge of textiles and clothing are fashion coordinators or personal shoppers. A few work as fashion designers. Some enter the retail clothing field and work up to positions as buyers or other executives. (See chapter on Department Stores.) A related field is that of interior design where the home economist designs interior decorations, arranges displays for business establishments, and counsels on home decoration.

Some home economists specialize in *housing*, advising architectural firms on home planning, equipment arrangements, and the selection and use of household appliances. A few are employed in *finance*, where they advise bank customers on family spending and saving in relation to the household budget.

Related Fields of Work. Home economists also work in *research laboratories*, specializing in the analysis, development or use of foods, equipment, or household supplies, or other aspects of home economics. The U. S. Department of Agriculture employs about 140 home economists in research on clothing, equipment, food preparation, nutrition, and general household economics. Some are employed in research by other Federal agencies, State agricultural experiment stations, colleges, and commercial establishments.

About 300 home economists are employed by State, county, city, and voluntary agencies in the *social-welfare* field. They act as advisers and consultants to work out budget standards for families, taking into account the funds needed for shelter, food, clothing, and household supplies to provide minimum healthful living standards.

Training in home economics is useful in a number of other related fields. About 250 specialists in child development and family relations are employed as teachers in *nursery schools*, *kindergartens*, *recreation centers*, *or children's institutions*. A few work as counselors and consultants in *rehabilitation* programs.

Training and Other Qualifications

About 500 colleges and universities grant degrees with majors in home economics. Most colleges and some other organizations interested in education offer promising students scholarships, fellowships, and loans—the latter sometimes without the payment of interest.

Completion of a 4-year course leading to a bachelor's degree in a home economics department of an accredited college or university is required for professional work in home economics. Undergraduates majoring in home economics usually take certain general or basic courses, including such subjects as English and the humanities; social, physical, and biological sciences; psychology; art and design; child development; family relationships; foods and nutrition; health and hygiene; home management and family economics; housing; household equipment and homefurnishing; and textiles and clothing.

Additional professional courses are taken, depending on the area of specialization. A student majoring in dietetics, for example, would take advanced courses in dietetics, nutrition, and food economics, as well as chemistry, bacteriology, and such subjects as institutional organization and administration. Persons majoring in dietetics often serve 1-year internships in hospitals or other training centers after receipt of the bachelor's degree, as indicated in the statement on dietitians elsewhere in this Handbook. A student majoring in textiles and clothing would be required to take advanced courses having a direct relationship to that specialized field. A person preparing to teach would need to fulfill the general requirements for teachers, in addition to having a major in home economics. Some types of work, such as certain kinds of research and college teaching positions, require a master's or a doctor's degree.

Among personal qualifications, home economists must like to work with people and be interested in them. They must be able to work with persons with different standards and backgrounds and should have a capacity for leadership with the ability to inspire cooperation.

Employment Outlook

For a number of years, the demand for home economists has far exceeded the supply. In this predominantly woman's occupation, many opportunities are created each year by the high turnover due to marriage and home responsibilities.

The shortage of home economists in the high school teaching field is especially critical. One-third to one-fourth of all secondary teaching positions become vacant yearly, and it is estimated that as many as 5,000 home economics graduates are needed annually for replacement purposes. In addition, teachers are needed in schools that are expanding their home economics departments or installing such departments for the first time. Additional teachers are needed also to take care of expanding enrollments in secondary schools. Since 1950, the number of college graduates with home economics majors who have prepared to teach has increased only slightly, from 2,886 to 3,124; moreover, some of the home economics graduates who prepare to teach do not, in fact, become classroom teachers.

In other specializations, the need is also great. The demand far exceeds the supply in the expanding fields for home economists in research and in business. Home economists with advanced degrees are needed especially in college teaching, administrative work, and research.

The shortage of home economists is expected to continue well into the 1960's. The increasing demand for their services in many fields, population growth, and the insufficient numbers of graduates in home economics indicate a growing need for persons trained as home economists for an indefinite period.

Earnings and Working Conditions

Salaries in this profession depend greatly upon the field of work and amount of experience.

The average beginning salary for a high school teacher of home economics was slightly under $4,000 a year in 1956. Experienced teachers in city school systems averaged $4,800 in large communities, with some exceeding $6,000. College professors of home economics average about $7,000, with deans and department heads receiving up to $12,000 a year.

The lowest paid group of home economists in business received $3,000 but some experienced workers in this field were paid up to $10,000 or more.

Hours of work may be irregular for some home economists, as for example, those engaged in promotional and advertising work who are expected to be available for evening meetings or other nightwork. On the other hand, research workers and others employed in business and manufacturing establishments may work a 40-hour week or less. Most home economists outside of the teaching field receive up to a month of paid annual leave or vacation. Adequate paid sick leave, retirement pay, and insurance benefits are generally available also.

Where To Go for More Information

American Home Economics Association,
1600 20th St., NW., Washington 6, D. C.

Information on U. S. Civil Service examinations is given in the chapter on Government Occupations. (See index for page numbers.)

Interior Designers and Decorators

(D. O. T. 0–43.40)

Nature of Work

Although artists have for centuries been employed to beautify palaces and public buildings, interior decorating as a distinct occupation in this country is only about 50 years old. Nowadays, interior designers and decorators plan and supervise the furnishing of private homes and other structures, including offices, hotels, restaurants, stores, and ships. They also work on theater, motion picture, and television set decorations.

On most decorating jobs, the structure is determined before the decorator arrives on the scene—that is, the walls, doors, windows, heating outlets, and the like are in place. The decorator then selects and arranges the furniture, draperies, wall and floor coverings, lighting fixtures, lamps, and other decorative accessories, and may also design cupboards, bookcases, and other "built-ins." On some jobs, he may also work with the architect in planning the interior of a new building or in re-

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modeling an old one. This work is known as interior design.

The first step in a decorating job is usually to prepare a color scheme and a plan showing the placement of the furniture, accessories, and floor and wall coverings. The decorator may also—and for larger assignments usually does—make drawings or water colors of the finished interior, to illustrate his scheme. As a rule, he must furnish complete cost estimates for the client's approval. The second step is to assemble the furnishings. A good deal of the decorator's time goes into selecting the furniture, textiles, rugs, and decorative accessories and into supervising the painters, upholsterers, and other craftsmen who work on the interior and the furnishings. His job is not finished until everything is in place and in good order.

Where Employed

According to one estimate, there were somewhat more than 10,000 interior decorators in 1956, many of whom were women. In addition, there were undoubtedly many other people, some of them part-time workers, who considered themselves interior decorators but who had little training in the field.

A sizable proportion of decorators have their own establishments. Some of these are "consulting decorators," who have no stock of furniture or fabrics to sell. More often, however, decorating establishments do have some furniture, decorative accessories, and fabrics for sale, since they find these attract clients for their services. Such decorating establishments vary greatly in size; many are operated by a single decorator with 1 assistant; others employ as many as 15 or more salespeople and decorators.

In recent years, large retail stores have become increasingly important as sources of employment for decorators. Most leading department and furniture stores have a decorating department. One of the main functions of the department is to help in the store's sale of its merchandise, though the decorators are rarely restricted to the store's stock in their plans for interiors. Department store decorators may also act as "homefurnishings coordinators," who advise the merchandising division and buyers concerning style and color trends in homefurnishings; this function is expected to become increasingly important. In addition, small numbers of interior designers and decorators are employed by architects, antique dealers, industrial designers, periodicals which feature articles on homefurnishings, and manufacturers in this field.

Since the business requires being near centers of population, the majority of decorators are located in large cities and their suburbs.

Training and Other Qualifications

Some of the successful interior decorators have "grown up" with this comparatively new field of work, and it is still possible to become a decorator with little or no formal training. An untrained person or one with very little training is at a distinct disadvantage in trying to enter the field, however, since very few reputable decorating firms or department stores will accept such people in beginning jobs. The best preparation for becoming an interior decorator is a 3-year course from a recognized art school, or a 4-year college course leading to a Bachelor of Fine Arts degree, with a major in interior decoration.

Personality plays an important role in the career of an interior decorator, since his success will in good measure depend on his ability to sell. The decorator who has his own establishment needs business ability, as well as good salesmanship and a pleasing personality. The high school student who plans to become an interior decorator should also have some aptitude for drawing and an interest in art.

The course of study in interior decorating usually includes the principles and history of art, freehand and mechanical drawing, painting, and study of the various materials, such as woods and fabrics, with which the decorator works. In addition, business courses such as salesmanship and business arithmetic are of great value.

The new graduate is not accepted as a qualified decorator, but is expected to serve an informal apprenticeship in the field, either with a decorating firm or in a department store. The apprentice may act as a receptionist, as a shopper with the task of matching materials or finding accessories, as a stockroom assistant, or as an assistant draftsman. Not all new graduates obtain these informal apprenticeships, since there are usually fewer openings than graduates. Those who fail to ob-

tain these jobs are advised to work as salespeople in fabric, lamp, or other homefurnishings establishments or departments, to gain experience in dealing with customers. Such experience will make it easier to obtain an apprenticeship with a decorating firm or department. It may also ultimately lead to a career in merchandising or as a buyer.

The length of the on-the-job training period varies, depending on the individual's performance and the establishment's requirements. In many cases, the apprentice progresses from simple to more complex assignments without a change of title. In other cases, the young worker may be promoted to "assistant decorator" and given full responsibility for a limited assignment, such as a single room. In any case, it is likely to take at least from 1 to 3 years before one advances to the position of decorator. After additional experience, the decorator may advance to head of a decorating department in a store, may open his own decorating establishment, or may develop into a stylist or homefurnishings coordinator.

Employment Outlook

Not long ago, only wealthy people and a limited number of businesses and institutions used the services of interior decorators. In recent years, however, decorating service has been made available to the general public at lower cost and people have become increasingly aware of the contribution a decorator can make to the comfort and beauty of a home. As a result, the demand for interior decorating has been growing and is expected to increase in the future. Despite this growth, however, the field has remained very competitive, and new entrants still find it difficult to gain a foothold.

One reason for the competitive character of the field is the ease of entrance resulting from the lack of established and accepted standards. Anyone who wishes to call himself a decorator can do so; and many women, having furnished their homes to their own and their friends' satisfaction, start a small decorating business. Consumers often have no way of evaluating the services offered by decorators, and will sometimes choose the amateur whose services may appear less expensive.

In recent years, department and furniture stores have played an increasingly important role in interior decoration for the home. At the same time, the growing volume of commercial and institutional work has most often been placed with the larger decorating establishments. It is expected that the larger establishments, both stores and decorating firms, will gain an increasing share of the expanding decorating business. This development will make for greater orderliness in the trade and provide increased opportunities for regular employment, as opposed to private practice. On the other hand, interior decorating, like all luxury trades, has in the past had marked ups and downs depending on general economic conditions, and would undoubtedly again suffer sharp reverses during a period of economic decline.

Earnings

Entrance salaries for graduates of interior decorating schools or of college courses in interior decorating were typically between $45 and $60 a week in 1956, according to limited data for decorating departments and establishments in some eastern cities. Assistant and full-fledged decorators may be paid either a straight salary, a salary plus commission or bonus, or a straight commission. The earnings of most department store decorators are usually figured directly as a percentage of their sales. Decorating establishments may also offer their employees a proportion of the profits, particularly if the customer is the employee's personal contact.

Independent decorators, like decorating firms and department stores, rarely charge a fee for their services. They generally rely on the profit which they make on furnishings sold to customers for their income.

The fact that earnings are so closely geared to sales means that, for both employed and independent decorators, the income range is very wide. Some decorators barely earn a living, whereas others make $20,000 or more a year.

Where To Go for More Information

American Institute of Decorators,
673 Fifth Ave., New York 22, N. Y.

modeling an old one. This work is known as interior design.

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The length of the on-the-job training period varies, depending on the individual's performance and the establishment's requirements. In many cases, the apprentice progresses from simple to more complex assignments without a change of title. In other cases, the young worker may be promoted to "assistant decorator" and given full responsibility for a limited assignment, such as a single room. In any case, it is likely to take at least from 1 to 3 years before one advances to the position of decorator. After additional experience, the decorator may advance to head of a decorating department in a store, may open his own decorating establishment, or may develop into a stylist or homefurnishings coordinator.

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Independent decorators, like decorating firms and department stores, rarely charge a fee for their services. They generally rely on the profit which they make on furnishings sold to customers for their income.

The fact that earnings are so closely geared to sales means that, for both employed and independent decorators, the income range is very wide. Some decorators barely earn a living, whereas others make $20,000 or more a year.

Where To Go for More Information

American Institute of Decorators,
673 Fifth Ave., New York 22, N. Y.

Lawyers

(D. O. T. 0–22.)

Nature of Work

Lawyers (attorneys) advise clients on their legal rights and obligations and represent them in courts of law. In addition, they negotiate settlements out of court and represent clients before quasi-judicial or administrative agencies of the government. They may also act as trustees, guardians, or executors. Government attorneys play a large part in administering Federal and State laws and programs; they prepare drafts of proposed legislation; establish procedures for law enforcement; and argue cases in the courts. Some lawyers serve as judges in Federal, State, and local courts. Others are primarily engaged in teaching, research, writing, or administrative activities.

Most lawyers are engaged in general practice and handle all kinds of legal work for their clients. An increasing number, however, specialize in particular phases of the law or in certain types of legal work. The branches of the law in which lawyers are most likely to specialize include: administrative, admiralty, corporation, criminal, estates and wills, international, labor, patent, real estate, trust, and tax law. Some attorneys devote themselves entirely to trying cases in the courts. Others never appear in court and limit their work to activities such as drawing up legal documents, conducting out-of-court negotiations, or doing the legal work necessary to prepare for a trial.

Many persons with legal training are not employed as lawyers but are in other occupations which require some knowledge of law. They may, for example, be FBI agents, insurance adjustors, tax collectors, probation officers, credit investigators, or claims examiners and adjudicators.

Where Employed

About 80 percent of the 220,000 lawyers listed by the American Bar Association as professionally active in 1955 were in private practice. More than two-thirds of the private practitioners were in practice by themselves; more than one-fourth were in a partnership; and the remainder—only about 5 percent—worked for other lawyers or law firms.

The greatest number of salaried attorneys are employed by government agencies. In 1955, about 8,000 held positions with municipal governments. The Federal Government employed approximately 6,000 attorneys, chiefly in the Department of Justice, the Department of Defense, and the Veterans Administration. About another 3,000 were military personnel serving as attorneys in the Armed Forces. A few thousand were employed by State Governments. More than 7,000 held judicial positions.

The second largest number of salaried lawyers work for private companies, including large manufacturing firms, banks, insurance companies, real estate firms, and public utilities. Most of the remainder teach in law schools. Some lawyers combine salaried and independent practice; others do legal work on a part-time basis while primarily employed in another occupation.

Although lawyers practice in all parts of the country, including small towns and rural areas, they are concentrated in cities and in the States with the greatest population. In 1955, about 30 percent of all lawyers were in New York City, Chicago, Washington, D. C., Los Angeles, Boston, Detroit, Philadelphia, and Cleveland. Almost half were located in the following States: New York, California, Illinois, Ohio, Texas, and Pennsylvania.

Training and Other Qualifications

Before a lawyer can practice in the courts of any State he must be admitted to the bar of that State. Applicants must pass a written examination, with the exception that, in a few States, graduates of certain in-State law schools are admitted to the bar without examination. If a lawyer has been admitted to the bar in one State, he can usually be admitted to practice in another State without taking an examination, provided he is of good moral character and has a specified amount of experience. The right to practice before Federal courts and agencies is controlled by special rules of each court or agency.

To qualify for bar examinations in most States, an applicant must have completed 2 or 3 years of college work and, in addition, must be a graduate

of a law school approved by the American Bar Association or the proper State authorities. Some States will accept study in a law office instead of, or in combination with, study in a law school—though this method of training is now rarely used. A few States require a period of clerkship in a law office after graduation. A number of States require registration and approval by the State board before students enter law school.

Of the 165 law schools in operation in 1955, 127 were approved by the American Bar Association and the others—chiefly night schools—were approved by State authorities only. A substantial number of full-time law schools also have night divisions designed to meet the needs of part-time students; some law schools have only night classes. Four years of part-time study is usually required to complete the night-school curriculum. In 1955, more than one-third of all law students were enrolled in evening classes.

Six years of full-time training after high school are generally required to become a lawyer. As a rule, this consists of 3 years of college study followed by 3 years in law school. However, law schools which have a 4-year, full-time curriculum may accept students after 2 years of college work. On the other hand, some schools require applicants to have a college degree. Specific college subjects are not generally required for entrance into law school. Students interested in a particular aspect of the law may find it helpful to take related courses; for example, engineering and science courses would be useful to the prospective patent attorney, and accounting would be useful to the future tax lawyer.

Although qualified young people interested in a legal career can usually obtain admission to a law school, they may not always be able to enroll in the school of their choice. Some of the more widely known schools frequently have more applicants than they can accept. In selecting students, law schools generally consider college grades, amount of college education, the particular college attended, and recommendations made by college professors. A number of law schools require applicants to take the standard law school admission test, and several give their own aptitude tests.

The first 2 years of law school are generally devoted to fundamental courses such as contracts, criminal law, property, torts, and equity. The third year is composed largely of elective courses in specialized fields such as tax, labor, or corporation law. Practical experience is often obtained in the school's practice court where the students conduct trials under the supervision of experienced jurists. Upon graduation, the degree of bachelor of laws (LL.B.) is awarded by most schools, although a few confer the degree of juris doctor (J.D.). Advanced study is often desirable for those planning to specialize in one branch of the law or to engage in research and law school teaching.

Most beginning lawyers start in salaried positions although some go into independent practice immediately after passing the bar examination. Young salaried attorneys usually act as assistants (law clerks) to experienced lawyers. As a rule, their work is limited to research such as checking points of law; they rarely see a client or argue a case in court. After several years of salaried employment, during which time they can obtain experience and funds and become known to potential clients, many lawyers go into practice for themselves.

Employment Outlook

Young lawyers starting independent practice in 1956 encountered considerable competition from established attorneys, particularly in large cities. Law school graduates in the top 10 percent of their class had good opportunities for obtaining salaried positions with well-known law firms, on legal staffs of corporations and government agencies, and as law clerks to judges. Graduates of the less widely known schools and those with lower academic ratings often experienced difficulty in finding salaried positions as lawyers. An appreciable number were not working as lawyers but held government and industry positions which required some legal training.

During the late 1950's and early 1960's, at least 5,500 lawyers will be needed each year to replace those who die, retire, or otherwise leave the profession. Some additional graduates will also be required to fill new jobs created by the expected

gradual increase in demand for legal services. However, the supply of lawyers will probably be more than sufficient to meet the demand even if the number of law school graduates increases at a somewhat slower rate than that anticipated for all college graduates. As a result, the legal profession is expected to remain highly competitive and some law school graduates may have to seek employment in related work.

Young attorneys entering private practice will, as in the past, generally face a "starvation period" of several years while they build up their clientele. Prospects for establishing a new practice will probably continue to be best in small towns and expanding suburban areas since, in big cities, competition with other lawyers tends to be keener, overhead costs are higher, and the difficulties of becoming known to potential clients are greater. On the other hand, opportunities for salaried employment will be limited largely to big cities where the chief employers of legal talent—government agencies, law firms, and big corporations—are generally located. For able and well-qualified lawyers, good opportunities to advance will continue to exist in both salaried employment and private practice.

A gradual increase in the legal profession is expected over the long run, primarily as a result of the continued growth of business activity and the country's anticipated population expansion. The trend toward more complex legislation at Federal, State, and local levels points toward the need for more salaried lawyers as well as for more independent practitioners. In addition, the increased use of legal services by low- and middle-income groups—stimulated in part by lawyer reference plans and legal aid societies—will add to the long-term growth in demand for lawyers. The growing complexity of business and government activities is expected to create a steadily expanding demand for lawyers who are specialists in such fields as corporation, patent, administrative, labor, and international law. Moreover, considerable numbers will continue to be needed as replacements for those who leave the profession.

Opportunities for women lawyers, who comprised less than 3 percent of the profession in 1955, will probably continue to be limited for some time to come. Although more than half of all women lawyers are employed in salaried positions, a substantial number are in practice for themselves. Many women lawyers hold positions, not as attorneys, but in occupations requiring a knowledge of law.

Earnings and Working Conditions

Beginning salaries for young lawyers are generally highest in large law firms and Federal agencies. Those employed by medium-size law firms, corporations, and banks generally earn somewhat less, and inexperienced lawyers working for small law offices or engaged in legal-aid work usually receive the lowest salaries. The beginning lawyer in practice for himself generally makes little more than his expenses during the first few years and often has some other source of income.

Lawyers in practice less than 5 years earned, on the average, about $5,000 in 1954, according to a U. S. Department of Commerce survey. As a rule, beginners in practice for themselves earned less than those in salaried positions. The average annual income above expenses for all lawyers surveyed in 1954 was approximately $10,200. About 5 percent of the lawyers reported earnings of $25,000 or more a year. On the average, incomes of lawyers in large cities were higher than those of lawyers located in small communities. Earnings of salaried attorneys employed by law firms were generally highest in large firms.

Lawyers often work long hours and under considerable pressure when a case is being tried. In addition, they must keep abreast of the latest laws and court decisions. However, since lawyers in private practice are able to determine their own hours and workload, many stay in practice until well past 70 years of age.

Where To Go for More Information

The specific requirements for admission to the bar in a particular State may be obtained from the clerk of the Supreme Court or the secretary of the Board of Examiners at the State capital. Information on law schools and on law as a career is available from:

The American Bar Association,
1155 East 60th St., Chicago 37, Ill.

Librarians*

(D. O. T. 0–23.20)

Nature of Work

Librarians are concerned with making knowledge and information available to the public, chiefly through such printed or recorded materials as books, periodicals, pamphlets, and reports. Since a number of libraries have recently begun to loan phonograph records and film, as well as books, librarians may also be concerned with these mediums. Librarians select and purchase books and such other materials as the library loans or uses; classify, catalog, and circulate books and other loan items; publicize library services; investigate the reading interests of people served by the library in order to meet these needs; do research to secure facts or information requested; and guide readers of all ages to books and information suited to their individual interests.

Librarians may also collect, review, and abstract published and unpublished materials in order to prepare bibliographies and book reviews which make information about books and other publications more readily available to the public. Some librarians serve as advisers to schools or other organizations on bibliography and references for research.

In a small library, the librarian may perform all of these duties, whereas in a large organization different librarians may handle each function. Some may specialize in a particular subject-matter area. For example, a medical librarian maintains and distributes a collection of medical texts, reference books, and research materials relating to the medical profession; a law librarian maintains and circulates materials used in the legal profession; a children's librarian assists children with their school and leisure interests by securing and distributing books and other reading materials of particular importance to children; and a business librarian selects, reviews, collects, and distributes books and periodicals on developments in business and industry.

Where Employed

Librarians are employed in public libraries and in libraries maintained by public and private schools, colleges, and universities, government agencies, research associations, and business and industrial firms. In the United States in 1950, more than 55,000 librarians were employed, of whom almost 90 percent were women. About two-thirds of these women were employed in public libraries or in the libraries of public schools. In recent years, more men have been entering the library field partly because of the increased salaries being offered, the growing emphasis on library service in scientific and technical fields, and improved opportunities for advancement to administrative positions.

In 1956, most of the librarians—some 44,000—were employed by the 7,500 public library systems in the United States. The remainder were employed by school, college, special, and Federal Government libraries, including libraries serving the Armed Forces, and United States Information Service libraries in all parts of the world.

Many elementary and secondary schools had their own libraries, and about 1,850 libraries were maintained by colleges and universities. More than 3,000 special libraries were operated by research agencies and private firms. These special libraries serve the particular interests of the employing organization rather than the wide range of public interest. For example, the library of a scientific research organization deals exclusively with materials suited to the conduct of specified areas of research, whereas an insurance company library concentrates on materials related to the insurance business. An estimated 150 libraries were run by agencies of the Federal Government. The Library of Congress, which is an agency of the Federal Government, is the outstanding example of a comprehensive library operation. It is the largest library in the United States. According to law, a copy of every book or pamphlet which has been copyrighted in this country must be deposited in this library.

Although most libraries are located in cities and towns, a new type of library (the bookmobile) has been developed in recent years to serve large geographical areas. About 1,000 of these bookmobiles were in use in 1956, traveling from village to village to provide library services to people who would otherwise have had to travel long distances to reach a library. Similarly, bookmobiles are

*Prepared by the Women's Bureau, U. S. Department of Labor.

used in some large cities where they prove more effective and economical than established branches in outlying areas.

Training and Other Qualifications

Positions as librarians in small school or public libraries and in the Federal Government may be secured after completion of a 4-year undergraduate course in library science at a college or university. Approximately 500 colleges and universities offered such courses in 1953. In addition, some positions for special librarians may be open to persons with specialized education and experience in a particular field, such as law, medicine, engineering, or business, even though they have had no library training.

In recent years, however, the trend has been toward requiring the completion of a 1-year curriculum in a library school, following graduation from a 4-year college, for "professional librarians." Entrance requirements for professional library schools commonly include: (1) graduation from an approved 4-year college or university; (2) a superior undergraduate academic record; (3) evidence, through credit or examination, of a thorough knowledge of the fundamentals of library work; and (4) a reading knowledge of at least one foreign language. Also, skill in typing is usually expected of students in library schools.

Most library schools grant the master's degree upon completion of 1 year's residence work in library science plus an extra summer semester or quarter. In 1956, there were 35 of these graduate schools in the United States and Canada which were accredited by the American Library Association Committee on Accreditation.

Many library positions require more than 1 year of specialized courses in library science. Certain positions for special librarians, for example, require completion of courses dealing with the subject matter with which the librarian will work. For example, a librarian who intends to specialize in a scientific field would have to take courses in mathematics and chemistry, physics, or engineering, depending upon the particular specialty; and a business librarian would have to study economics, business management, accounting, and finance.

Advancement for the librarian may come through transfer to a larger library or by promotion to a higher grade position in the same library. Promotions to administrative positions or to specialized work are also possible after additional education or experience. It should be noted, however, that advancement to higher level or specialized positions may be limited to "professional librarians" who have completed graduate training in an accredited library school.

Since certification is required for many library positions and the requirements therefor may be established by local, county, or State agencies, these requirements should be investigated by the student through the school or college counselor or the American Library Association.

Employment Outlook

Library schools and associations reported a nationwide demand for well-trained librarians in 1956. There were an estimated 10,000 unfilled positions for professional librarians that year.

Since World War II, the number of degrees granted in library science has been less than 2,000 a year, and library schools have regularly reported 100-percent placement of graduates. According to a 1953 survey, there was a shortage of graduates from accredited library schools to fill jobs in cataloging, library work with children, school librarianships, and special library services in science and technology. It has been estimated that there were some 6,000 openings for school librarians in 1954 and at least 1,000 openings in the special library field in 1955. Most of the latter were in science and technology. Less than 15 percent of the library school graduates in 1954 entered the special library field, and only about 2 percent were in science and technology. The majority of graduates took school or public library positions.

The demand for librarians is expected to continue and to increase for the remainder of the 1950's and well into the 1960's. The expanding school population and improved standards for school libraries will necessitate the employment of a growing number of fully trained librarians. Many additional openings will be created by turnover among young women in the field who leave their jobs for marriage and family reasons. Special librarians, particularly in science and technology, will be greatly in demand as a result of the increasing interest in industrial research.

The supply of graduates from accredited library schools is expected to be insufficient to meet these

needs. Therefore, employment opportunities for trained workers will continue to be very good throughout this period. Those with special training in the sciences will have excellent opportunities, and mature workers, as well as those who can work only part time, will have good chances for employment.

Over the long run, employment for librarians, particularly the specialists, is expected to expand, as more and more new information becomes available and the complexity of our sources of knowledge increases.

Earnings and Working Conditions

Geographical region, size of city, size and type of library, and degree of responsibility and technical skill required are important factors influencing librarians' salaries. In 1956, the average salary for beginning library school graduates was $3,800 at year. Special librarians reported salaries beginning at $4,000, with science-technology specialists receiving about $1,000 more. A 1955–56 survey of 110 universities with large graduate programs showed salaries ranging from $5,800 to $15,900 a year for chief librarians. Their average salary was $9,200. Entrance salaries in the Federal Government in 1956 were $3,670 and $4,525 for librarians, depending upon the extent of their education and experience. Library assistants were hired at $2,690 and $2,960.

The typical workweek for librarians is 40 hours and may include evening work in those libraries that remain open evenings. The 5-day week is becoming common, and the usual vacation after a year's service is 4 weeks. In school libraries, the work year customarily coincides with the school year.

Where To Go for Further Information

Additional information, particularly on schools, requirements, and scholarships or loans may be obtained from:

American Library Association,
50 E. Huron St., Chicago 11, Ill.

Information on requirements and placement of special librarians may be secured from:

Special Libraries Association,
31 East 10th St., New York 3, N. Y.

Information about school library systems may be secured from:

U. S. Department of Health, Education, and Welfare,
Office of Education, Washington 25, D. C.

Newspaper Reporters

(D. O. T. 0–06.71)

Nature of Work

Reporters collect information on news events and write news stories for publication in daily or weekly newspapers. They gather information by interviewing people, consulting police and other public records, observing events as they happen, and by doing research in libraries. As a rule, reporters take brief notes while collecting facts and type their stories upon return to the office. Sometimes, to meet deadlines, they telephone the information to other reporters, known as "rewrite men," who write the stories for them.

Big city dailies frequently assign some reporters to special "beats," such as police stations or courts, to cover news originating in these places, while local news which develops elsewhere is handled by general assignment reporters. News on certain subjects such as sports, politics, and religion is often dealt with by specialists in these fields. Reporters on small newspapers not only cover all aspects of local news but may also take photographs, write headlines, lay out inside pages, and even write editorials. On the smallest weeklies, they may also solicit advertisements, sell subscriptions, and perform general office work.

Newspaper reporting is only one of several occupations open to young people trained in journalism. Persons with this background may also work for general circulation magazines, trade, business, labor, and other specialized periodicals; for radio and television stations, advertising agencies, and public relations firms; and for government agencies. These related activities are not dealt with in this statement.

Of approximately 60,000 editors and reporters employed in the printing and publishing industries in 1950, it is estimated that about half were newspaper reporters. Although women composed almost one-third of the combined group, the pro-

Newspaper reporter phoning in a story to the city desk.

portion of newspaper reporters who were women was much smaller.

Where Employed

The majority of reporters are employed by daily newspapers and most of the others work for weekly papers. In addition, some reporters are employed by press services and newspaper syndicates.

Reporters work in cities and towns of all sizes throughout the country. Of the approximately 1,800 daily and 9,000 weekly newspapers published in 1956, the great majority were in small towns. Sizable numbers of reporters, however, are located in cities since each large city daily employs many reporters whereas a small-town paper generally has only a few.

Training and Other Qualifications

Although talented writers with little or no academic training beyond high school can become reporters, an increasing number of newspapers require applicants to have a college education. Some editors prefer college graduates with a degree in journalism while others consider a degree in liberal arts equally desirable.

Professional training leading to a degree in journalism can be obtained in more than 150 colleges; about 100 of these have separate departments or schools of journalism. The typical 2-year journalism curriculum is given during the junior and senior years of college and is about equally divided between cultural and professional subjects. Professional subjects offered students preparing to become newspaper reporters include reporting, copyreading, editing, feature writing, and the history of journalism. Graduate training is a relatively recent development and, although a number of schools award master's degrees, only a few offer programs leading to the doctor's degree in journalism. In 1956, most schools and departments of journalism were not overcrowded and qualified applicants had an excellent chance of admittance.

Young people who wish to prepare for newspaper work by obtaining a liberal arts background in college should take English and specialized courses in writing as well as subjects such as sociology, political science, economics, history, and psychology. Those without college training usually qualify by gaining experience on rural, small-town, or suburban papers. The ability to write well and to report the news accurately are important for success in this field, as are such personal qualities as a "nose for news," persistence, initiative, resourcefulness, and an accurate memory.

Most beginners become "cub" reporters on weekly or small daily newspapers. However, some college graduates start as copy boys on large city papers and occasionally obtain promotions to reporting jobs. Other graduates are hired directly for reporting positions by some large newspapers that prefer to train them on the job. In competing for regular positions, it is helpful to have had experience as a "stringer"—one who covers the news in a particular area for a newspaper and is paid on the basis of the stories printed.

"Cub" reporters are assigned to such work as summarizing speeches, covering relatively unimportant meetings or interviews, writing obituaries, and handling minor news events. As they gain experience, they may advance to covering more important developments or are assigned to a "beat" or special subject. For experienced reporters, advancement is possible to positions such as columnist, or correspondent, or editor. Newspapermen also progress by moving to reporting

jobs with larger papers or with press services and newspaper syndicates. Some reporters eventually advance to top executive positions or become publishers. Others transfer to related fields such as advertising, radio, television, or public relations.

Employment Outlook

Weekly or daily newspapers located in small towns and suburban areas offered the most opportunities to young people seeking work as newspaper reporters in 1956. City dailies provided some opportunities for beginners to start as copy boys with a chance of later advancement to reporting jobs. In addition, city newspapers occasionally employed beginners to fill openings for reporters, although experienced reporters were usually hired for such positions and there was considerable competition for reporting jobs in most large cities. Beside these opportunities in reporting, openings in related fields such as advertising, trade and technical publishing, radio, and television were readily available to new college graduates with journalism training.

During the late 1950's and early 1960's, most opportunities to enter newspaper reporting are expected to result from the need to replace reporters receiving promotions to editorial or other higher level positions, transferring to other fields of work, or lost to the profession through death or retirement. Although newspaper circulation is likely to grow and the number of pages per newspaper is expected to increase, newspapers will probably be able to take care of this expansion without a comparable rise in employment of reporters. Prospects for beginners are expected to remain best on small-town and suburban newspapers. On such papers, preference will probably continue to be given to beginning reporters who are versatile and able to help with photography and other aspects of the work and who are acquainted with the community. In view of the interest and attraction of newspaper work, there will probably always be many young people seeking to enter the field. However, talented individuals will—in the future as in the past—have a good chance of breaking into and advancing in the profession.

Special opportunities for women are to be found in reporting on subjects such as society news, food, fashions, clubs, and beauty culture for the society page of the women's section of newspapers. However, on some newspapers, women reporters are used on the same types of jobs as men. Women also have many prospects for employment in related fields of journalism.

Earnings and Working Conditions

Many daily newspapers have negotiated contracts with the American Newspaper Guild which set minimum wages for beginning reporters and provide for salary increases to be given annually for the first few years. In 1956, Guild minimum rates for reporters without any previous experience ranged from about $45 a week on a few of the smaller daily papers to more than $70 a week on a number of big city dailies. However, the majority of newspapers with Guild contracts paid beginning reporters between $50 and $65 a week. Young people starting as copy boys earn much less than new reporters.

Guild minimum rates for experienced reporters in 1956 ranged from $100 a week on the smaller papers to $130 a week and more on some big city papers. Well-qualified and experienced reporters are often paid salaries higher than the minimum rates called for in Guild contracts. Some particularly successful reporters on city dailies earn more than $200 a week.

Newspaper reporters on city papers generally work 8 hours a day, 5 days a week, although their hours are often irregular. Many of those employed by morning papers start work in the afternoon and finish around midnight. Large city papers pay overtime rates for more than 40 hours of work a week and often provide various employee benefits such as paid vacations, group insurance, and pensions.

Where To Go for More Information

Information about opportunities with daily newspapers may be obtained from:

American Newspaper Publishers Association,
370 Lexington Ave., New York 17, N. Y.

Information on union wage rates is available from:

American Newspaper Guild, Research Department,
1126 16th St., NW., Washington 6, D. C.

Names and locations of all daily newspapers and a list of departments and schools of journalism are published in Editor & Publisher International Yearbook, available in most large newspaper offices and public libraries.

Personnel Workers

(D. O. T. 0–39.81 through .83, .85 through .88, and 0–68.70 through .78)

Nature of Work

Personnel workers are concerned with helping management make the most effective use of employee abilities. They are responsible for the development of recruiting and hiring procedures and for the maintenance of personnel records. In addition, they may counsel employees, advise management in disciplinary matters such as the discharge of employees, classify jobs, plan wage and salary structures, develop safety programs, and conduct research in personnel methods. Labor relations, employee training, and the administration of retirement and other benefit plans are also important aspects of their work. (Personnel workers in schools and colleges who counsel students or are otherwise concerned with student problems are not dealt with in this report.)

Personnel work ranges from policymaking to routine administrative activities and includes a number of highly specialized functions. Industrial relations directors, personnel managers, training directors, and others in executive positions are generally concerned with formulating policy and advising management. Positions such as job analyst, personnel counselor, salary and wage administrator, and labor relations specialist require specialized training. Some personnel jobs deal with administrative details and procedures which are of a routine nature.

The types of personnel jobs found in a company depend on the size of the company and the extent of its personnel activities. In a small business, one person may handle all the personnel work and, in some cases, also have other duties. In a very large organization, on the other hand, the personnel department may have several hundred employees with highly specialized duties. The greatest number and variety of personnel positions are to be found in big companies whose personnel programs include labor relations, training, safety, job classification, and other specialized aspects of employee relations. Some business organizations limit their personnel activities largely to recruitment, handling of disciplinary problems, and maintenance of personnel records; these companies need fewer personnel workers.

Where Employed

Personnel workers are found in nearly all types of business enterprises as well as government agencies. Of the more than 50,000 personnel and labor relations workers employed in 1950, well over half worked for private industry. Industries employing large numbers are steel, automobile, and machinery manufacturing, telephone and other utilities, department stores, petroleum refining, and chemicals. About one-third of all personnel and labor relations workers are employed by Federal, State, and local government agencies, chiefly those of the Federal Government. In addition, a number are college teachers of personnel administration, industrial relations, and similar subjects. Some work independently, generally as management consultants or labor relations experts. Most personnel workers are located in big cities and in the highly industrialized sections of the country.

Training and Other Qualifications

A college education is becoming increasingly important for personnel work. However, many personnel executives are not college graduates but entered the field by advancing from production, sales, or clerical jobs, and this method of entry is still open for some jobs in private industry. For professional positions with the Federal Government, a bachelor's degree is generally needed. Some specialized positions in both private industry and government service require advanced training beyond the bachelor's degree.

College courses in personnel management, business administration, public administration, psychology, statistics, economics, political science, sociology, English, and public speaking are regarded as desirable preparation for personnel work. Although some employers in private industry prefer college graduates who have majored in personnel administration, many consider such training too specialized and prefer those with a general business administration background. Other employers consider a well-rounded liberal arts education the most desirable preparation for personnel work. Young people interested in gov-

ernment positions are often advised to major in public administration, political science, or personnel administration; however, those with other academic backgrounds are also eligible for government employment.

For some positions, more specialized training may be necessary. Jobs involving testing and counseling often require a bachelor's degree with a major in psychology or even a graduate degree in this field. An engineering degree may be needed for work dealing with time study or safety standards, and a degree in industrial relations may be helpful for work involving labor relations. A background in accounting and law is also very useful for those aspects of personnel work dealing with wages, pension and other employee benefit plans, and labor relations.

Most employers perfer personnel workers who have had firsthand experience with the operations of the company and with the type of work performed by the employees. For this reason, many firms recruit new personnel staff members from their own employees—in which case, other qualifications often outweigh educational background. On the other hand, some companies and government agencies hire only college graduates and put them through in-service training programs that teach both the operations of the organization and specific personnel procedures. College graduates may also be employed directly for beginning jobs in personnel work as junior interviewer, personnel clerk, assistant job analyst, or labor relations assistant.

Qualities regarded as desirable for success in personnel work are the ability to speak and write well, plus more than average skill in working with people of all levels of intelligence and experience. In addition, the prospective personnel worker should have a liking for detail, a high degree of persuasiveness, and an attractive appearance.

Employment Outlook

Some opportunities to advance to personnel work will be available in the late 1950's for qualified young people willing to start in production, clerical, or subprofessional positions. However, new graduates seeking to enter professional personnel positions directly from college are expected to face keen competition in many parts of the country. A number of opportunities for immediate professional employment will be offered through in-service training programs for junior personnel workers conducted by large companies and Federal Government agencies. In general, employment prospects will be best for college graduates with specialized training in certain aspects of personnel work such as psychological testing, safety engineering, counseling, and industrial relations.

A gradual increase in the demand for personnel workers is expected over the long run. The anticipated expansion in the country's labor force will create a need for more personnel workers to carry on existing types of activities. In addition, a marked growth is expected in many aspects of personnel work. Increased recognition of the importance of the "human factor" in industry will bring about a demand for more executives trained in employee relations; wider use of psychological testing by employers will result in a need for additional staff; and growth of in-service training programs and their application to new problems will increase the size of training staffs. The demand for more labor relations experts is also expected to continue. Extension of employee services, growing emphasis on safety, development of pension and other benefit plans, and intensified research activities also point toward a future demand for more trained personnel workers. Moreover, additional workers will be needed to replace those lost to the field through retirement or death and for other reasons.

Opportunities for women, who constitute approximately one-fourth of all personnel workers, are expected to continue to expand. Prospects will remain best in organizations which have many women employees such as department stores, telephone companies, and government agencies. Although advancement opportunities will probably continue to be limited, a growing number of women are expected to attain top positions.

Earnings and Working Conditions

Beginning salaries for college graduates in professional personnel positions typically ranged from $3,000 to $4,500 a year in 1956. In the Federal Government, beginners with bachelor's degrees started at $3,670 a year and those with master's degrees at $4,525. Prospective personnel workers who held clerical, production, or subprofessional positions generally earned lower salaries.

The average salary paid personnel directors and others in top positions in 1956 was approximately $10,000 a year. However, annual salaries ranged from less than $5,000 in some small companies to more than $60,000 for vice presidents in charge of personnel or industrial relations in some giant corporations.

Employees in most personnel offices generally work 40 hours a week. However, during periods of intensive recruitment, strikes, or other unusual situations, considerable overtime work may be required. As a rule, personnel workers are paid for holidays and vacations.

Where To Go for More Information

General information on personnel work as a career may be obtained from:

The American Society for Personnel Administration, Kellog Center, East Lansing, Mich.

General information about public service careers, including personnel work, may be obtained from:

Public Personnel Association, 1313 East 60th St., Chicago 37, Ill.

American Society for Public Administration, 6042 Kimbark Ave., Chicago 37, Ill.

Psychologists

(D. O. T. 0–36.21 through .26)

Nature of Work

Psychologists study the behavior of people and use the knowledge gained to help individuals adjust successfully to home, social, school, and working situations. Many teach in colleges and universities or engage in research. Others apply psychological principles and methods in such activities as diagnosing and treating mental disorders, measuring aptitudes, counseling, and selecting workers for jobs. Altogether, in early 1956, there were about 20,000 professionally employed psychologists, of whom approximately one-fourth were women.

Psychologists may be divided into two major groups: Those who specialize in the applied fields of psychology and generally work directly with people, and those who specialize in the basic science fields and are employed mainly in research or college and university teaching. The largest number of psychologists, over one-third, are specialists in clinical psychology, an applied field which deals primarily with problems of maladjusted or disturbed people. They interview, give diagnostic tests, and provide group or individual psychotherapy. Specialists in counseling psychology, the second largest field, help students, the physically handicapped, and other individuals achieve educational, vocational, and social adjustment. Psychologists specializing in the other applied fields may deal with educational methods, personnel selection, and the efficiency of workers on the job. Many specialists in the applied fields do research work and college teaching—often on a part-time basis.

The basic science fields employ about one-fifth of all psychologists and include such specialties as social, experimental, and physiological psychology. A few examples of problems on which specialists in these fields may do research are: How leadership qualities are developed; how color is recognized; and how the brain functions under conditions of extreme fatigue.

Where Employed

Colleges and universities employ more than one-third of all professional psychologists. Federal Government agencies—chiefly the Veterans Administration, the Department of Defense, and the Public Health Service of the Department of Health, Education, and Welfare—employ the second largest group. In addition, large numbers work for State and local government agencies. Sizable groups also work for elementary and high schools, private industry, and nonprofit foundations, hospitals, and clinics. A small number serve as commissioned officers in the Armed Forces and the Public Health Service. A few psychologists, less than 5 percent, are in independent practice. In addition to positions with the title "psychologist," there are many personnel and administrative

jobs filled by persons trained in psychology. Most psychologists are employed in large cities and in university towns.

Training and Other Qualifications

The master's degree with a major in psychology is generally the minimum requirement for professional employment in the field of psychology. The Ph. D. degree is needed for many beginning jobs and is almost essential for advancement. The bachelor's degree is not considered sufficient education for professional employment, but some young people with this degree secure jobs of a routine nature in psychological work and in related work where training in psychology is helpful.

A Ph. D. in clinical or counseling psychology usually requires 4 or 5 years of graduate study, including 1 year of internship or supervised experience. In these specialties, the trend toward practical training often also extends the minimum time needed to earn the master's degree from 1 to 2 years. Specialists in the other psychological fields frequently complete the doctoral program in 3 or 4 years and can secure the master's degree in 1 year.

Most graduate schools prefer students with well-rounded educational preparation and do not require an undergraduate major in psychology. Students are selected primarily on the basis of college grades and their performance on aptitude tests. Emotional stability, interest in people, and social maturity are considered especially important for those preparing to enter the applied fields.

Many graduate students receive financial help from universities and other sources, either in the form of part-time employment as assistants or outright grants as fellows. Several Federal agencies provide funds to graduate students either directly or through the educational institution giving the training. The Veterans Administration offers a large number of 4-year doctoral traineeships, chiefly in clinical and counseling psychology, during which time students are paid for part-time employment with that agency. The Public Health Service supports doctoral traineeships in clinical psychology. The Office of Vocational Rehabilitation offers 2-year traineeships in vocational rehabilitation counseling, primarily for those working toward the master's degree.

Beginning psychologists with master's degrees qualify for jobs assisting in the administration and interpretation of psychological tests, analyzing and collecting statistical data, counseling in schools, performing routine administrative and personnel duties, or acting as vocational rehabilitation counselors. Those with doctorates qualify for more responsible research, clinical, and counseling positions as well as for teaching in colleges and universities. In considering the qualifications of psychologists, some employers are placing increasing emphasis on a sound knowledge of mathematics and of the biological and physical sciences.

To enter Government employment, psychologists must usually qualify through the Civil Service system. Those desiring to qualify for independent practice must meet certification or licensing requirements in an increasing number of States. Nine States—Arkansas, Connecticut, Georgia, Kentucky, Maine, Minnesota, Tennessee, Virginia, and Washington—had such requirements in 1955.

Employment Outlook

The strong demand for well-qualified psychologists which existed in early 1956 was expected to continue for several years. However, some inexperienced young people with only master's degrees were having difficulty finding work as psychologists, and this situation may persist.

Employment of psychologists will increase substantially during the 1960's; though perhaps at a slower rate than between 1945 and 1955 when the number in the profession tripled. In addition to the country's growing population, the following factors point toward long-term expansion of the profession: Increasing recognition by schools, government agencies, and private industry of the contributions that can be made by this relatively new science; growing concern about mental health needs, resulting in a tremendous increase in State funds available for the treatment of the mentally ill; and the emergence of the Federal Government as a major sponsor of psychological research not only within the Government but also in universities and private industry.

A considerable expansion is anticipated in the number of psychologists employed by State agencies. Currently understaffed mental hospitals and

mental hygiene clinics will need many clinical psychologists. Employment of vocational rehabilitation counselors in State programs is expected to increase from 1,600 in 1955 to more than 4,500 by the early 1960's, and will draw primarily upon psychologists with the master's degree who have specialized in rehabilitation work. In addition, the number of psychology teachers needed by colleges and universities will rise considerably, particularly during the 1960's (see statement on college and university teachers, p. 63), and substantial growth is expected in the number of psychologists employed in elementary and secondary schools. The trend toward greater use of psychological techniques by private industry is likely to continue, thereby creating new openings for experimental, personnel, and human engineering specialists.

The Federal Government, which employed 60 percent more psychologists in 1954 than in 1951, will remain an important source of employment. Many openings for psychologists with Ph. D.'s are expected at Veterans Administration hospitals. Such hospitals employed 600 clinical and 100 vocational counseling psychologists in 1955, and it is estimated they will need about 1,500 clinical psychologists and from 500 to 1,000 additional vocational counseling psychologists by the early 1970's. The Department of Defense will probably continue to have some openings for research psychologists who are specialists in experimental, physiological, human engineering, and personnel psychology. It should be kept in mind, however, that the number of Government positions is dependent on funds appropriated annually by Congress.

In addition to newly created jobs, some vacancies occur each year owing to deaths and retirements. However, such openings will be relatively few for several years since psychologists are a young group. The transfer of psychologists to work of a purely administrative nature also creates some job vacancies.

Most employment opportunities for women psychologists will probably continue to be in clinical and counseling psychology; in 1955, about half the women professionally employed as psychologists were clinical psychologists. Women often find it difficult to secure work with psychological consulting firms, in some kinds of military research, or as industrial psychologists.

Earnings and Working Conditions

Beginning salaries in early 1956 were generally around $5,000 for well-trained psychologists with Ph. D.'s. However, in the Federal Government and private industry, some psychologists with the doctorate started at $6,500. Those with only a master's degree generally began at salaries between $3,600 and $4,500.

Median earnings of psychologists—disregarding differences in training and experience—were $6,400 in 1954, according to a survey of 13,000 psychologists, chiefly members of the American Psychological Association. Psychologists working for private industry or consulting firms had median earnings of $7,000; those in the Federal Government or in the Armed Forces, $6,700; and those in colleges or universities, $5,800. Ph. D.'s averaged $7,800 a year and psychologists with only master's degrees, $5,100. Women Ph. D.'s had median earnings of $6,000, and those with master's degrees, $4,500. All these figures include not only regular salaries but also any additional income received from professional work, such as summer teaching and consulting.

Where To Go for More Information

General information on the professional, placement opportunities, and a list of universities with approved doctoral programs in clinical and counseling psychology may be secured from:

American Psychological Association,
1333 16th St. NW., Washington 6, D. C.

Information on traineeships and fellowships may be secured from colleges and universities with graduate psychology departments and from the following government agencies:

Chief, Vocational Counseling, Department of Medicine and Surgery or Chief, Clinical Psychology Division, Veterans Administration, Washington 25, D. C.

Office of Vocational Rehabilitation, U. S. Department of Health, Education, and Welfare, Washington 25, D. C.

Training and Standards Branch, National Institute of Mental Health, National Institutes of Health, Bethesda, Maryland

Social Workers*

(D. O. T. 0–27.06 to 0–27.50)

Nature of the Work and Where Employed

Social workers help people to solve their family, health, financial, or other problems which jeopardize their welfare. They provide financial aid, advice, and assistance in such matters as finding a job, arranging for medical care, or securing low-cost housing. They seek to change the attitudes and behavior of individuals when necessary to aid them in caring for themselves more effectively and in improving their relationships with others.

Of the 80,000 or more social workers in the country (most of whom are case workers) about two-thirds are government employees, mainly in public assistance or other welfare programs administered by State, county, or city governments. The remainder are employed by voluntary agencies, supported by contributions, endowments, or fees paid by those served. In proportion to the population, more social workers are employed in the North than in the South and more in the East than in the West. More work in urban than in rural areas. About 2 out of 3 are women.

Social Caseworkers Working With Families. Most social caseworkers work directly with individuals and families who have difficulties such as those arising from poor relationships between husband and wife or between parent and child, poor household management, ill health, or lack of income. More than 36,000 caseworkers in public assistance or other government welfare programs arrange for financial aid for the blind, aged, disabled, and unemployed and for children lacking one parent or both. Caseworkers may help employable people find jobs. They may also arrange for medical care or for the distribution of food and clothing to their clients.

Besides caseworkers in government agencies, over 5,000 family workers are employed by private agencies, for the most part to counsel troubled people. Only emergency financial aid is given by these private organizations as needy persons are referred to public assistance agencies. Among the larger of the private agencies in most cities are those affiliated nationally with the Family Service Association, Catholic Charities, Jewish Family Service, various Protestant churches, the Salvation Army, and the National Travelers' Aid.

Child-Welfare Workers. More than 14,000 social caseworkers in both government and private child-welfare agencies perform such services as placing neglected or mistreated children in foster homes, providing a temporary housekeeper in a home where the mother is in a hospital, counseling a youthful offender who has been brought before the juvenile court, aiding the unmarried mother and her child to find a satisfactory place in the community, or providing appliances for a crippled child.

School Social Workers. More than 1,000 school social caseworkers are employed in at least 500 school systems on a full-time basis. Other school social workers have classroom duties and devote only part of their time to social work. A school social worker may visit the home of the child with poor attendance, give guidance to aggressive or excessively shy children, or seek the causes of poor progress in the case of an intelligent child. Most of these workers are employed in large school systems. Seven States have legislation which provides for these services on a local basis.

Medical Social Workers. An estimated 6,000 social caseworkers work with doctors and nurses to aid patients when personal or emotional needs retard recovery. They are employed by public health departments, in hospitals, clinics, and health centers. They may work on such programs as those concerned with polio, heart disease, cancer, tuberculosis, and rehabilitation. The medical social worker may, for instance, aid a child amputee to develop a more healthful attitude toward his handicap, work with an uncooperative patient shying away from surgery, or instruct a discharged patient's family on his diet and care. The medical social worker helps both the patient and his family to understand the recommendations of the physician.

Psychiatric Social Workers. Nearly 2,300 social caseworkers are employed in mental hospitals

*Prepared by the Women's Bureau, U. S. Department of Labor.

or clinics and similar agencies for adults and children. They help the psychiatrist and other members of the psychiatric team plan for the patient and they interpret to the patient's family the meaning of mental illness. They also work with the patient after he returns home as well as with his family and community agencies.

One of the large employers of psychiatric social workers is the Veterans Administration. In veterans' hospitals and clinics, medical and psychiatric social workers are used interchangeably and both are known as clinical workers; in 1956, they numbered over 1,350.

Social Group Workers. A social group worker works with organized groups of all ages to develop the individual and to foster socially desirable behavior. Leisure-time activities programs may include handicrafts, games, hikes, dancing, and the like. Specially planned groups may also be set up for the treatment of emotionally disturbed persons or for redirecting the behavior of delinquent youth, under the guidance of fully trained social group workers.

Many of the 9,000 workers in this field are employed by youth-serving social agencies and settlement houses. Others work for the American Red Cross, recreation departments, camps, religious organizations, and such agencies as the Girl Scouts and the Camp Fire Girls. A small but increasing number are employed in hospitals, clinics, public social agencies, and in community programs for older workers.

Community Organization Workers. An estimated 2,000 to 3,000 social workers are employed by community chests, community welfare councils, and other community agencies which have responsibilities for health and welfare planning. They have such duties as determining whether additional social organizations are needed or recommending changes in social organizations already in existence to avoid duplication of effort. Some community organization workers set up and conduct fund-raising campaigns and supervise the disbursement of collected funds as directed by the community council.

Other Social Workers. Social workers are found performing a variety of other services. They work in all types of institutions, serving such groups as aged persons, delinquents, and adult offenders. About 3,000 are engaged in correctional work with those on probation or parole. Some 800 are teachers in schools of social work, almost half of them working part time. An estimated 500 specialists are in the social work research field in large cities and research centers, measuring the effectiveness of the social services rendered and seeking ways to improve methods of operation.

Some experienced social workers from the United States serve in other parts of the world. They may work as consultants in the rehabilitation of the disabled, as teachers in schools or seminars, or as administrators in setting up agencies and schools. They may be employees of the Federal Government, the United Nations or one of its affiliated groups, national professional associations, or private agencies such as the American Friends Service Committee, the American Red Cross, United Hebrew Immigrants Aid Society, the Young Women's Christian Association, and the Catholic Relief Service.

Training, Other Qualifications, and Advancement

The social work profession considers 2 years of graduate training, in 1 of the 51 approved schools of social work in the United States, as a desirable standard for professional social workers and is encouraging adherence to this standard by educators and employers of social workers. In these schools, the student is helped to develop an ability to perform social work functions through classroom courses, field work, and research. Basic training is the same for all types of workers. For admission to schools of social work, the applicant must have earned a bachelor's degree in an approved liberal arts college.

For the student planning to become a social worker, undergraduate work should include such courses as economics, political science, psychology, sociology, statistical methods, and the biological sciences. English composition and public speaking courses help in preparing records, interviewing, and participating in meetings and conferences. Possibly 200 colleges and universities offer upperclassmen one or more undergraduate, introductory courses in social work. About half of them offer 10 or more semester hours in an organized sequence and are members of the Undergraduate Division of the Council of Social Work Education. Although these courses

are not required for entrance to graduate schools of social work, they give the interested student an excellent introduction to the work.

In addition to adequate training, a student in social work should have a warm interest in people and in social problems, a mature and unbiased outlook, and should be able to exercise good judgment. Students at all levels will find helpful such experiences as serving as a part-time volunteer, or as a summer employee, in camps, social settlements, hospitals, and social agencies.

In relation to the number of students in this field, more financial aid for students with good academic records is available for graduate study in social work than in most professions. In 1955, approximately 70 percent of graduate social work students were receiving such aid. Scholarships are offered by graduate schools, private agencies, foundations, civic groups, and State Governments for those with good scholastic standing. Sometimes aid is offered contingent upon the student's pledge to return to work for the financing agency. Agencies often grant leave of absence and give scholarships to promising employees to encourage graduate study. In other instances, students are paid for part-time social work, thus providing funds for their professional education.

Such, however, is the shortage of qualified personnel in this profession that about three-fourths of the social workers in 1956 had less than 1 year of professional education. The proportion of those with graduate preparation ranges from 22 percent among public assistance workers to 60 percent among child-welfare workers. In some large cities, where higher salaries are paid, the proportion of all types of social workers with 2 years of professional education reaches 72 percent. Some assisting or aide positions, however, (notably in public-assistance programs) may be entered without a bachelor's degree.

As workers gain experience and demonstrate ability, they have many opportunities for advancement into higher level positions, such as senior staff member, supervisor, executive, teacher, or research worker. However, advancement is limited for those lacking graduate professional education in an accredited school of social work.

Employment Outlook

Nearly 7,000 students were enrolled in graduate schools of social work in 1955; more than 1,500 students earned a master's degree in that year. Following a 20-percent decrease in enrollment between 1950 and 1954, there was a 30-percent increase in the number of students between 1954 and 1955. Even after this recovery, the capacity of these schools was not being fully utilized. Not enough graduates are entering the field to replace those who are retiring, to fill vacancies, to enlarge existing services, and to man new services.

An estimated 10,000 vacancies existed in 1956 throughout the entire field of social work. There were numerous examples of specific shortages. Three thousand vacancies were reported in the public assistance and child-welfare fields in 1956 and more than 100 vacancies existed in the Veterans Administration. Several hundred social workers were also needed in each of the following fields: Corrections, mental health, rehabilitation, school work, and group work. Many of the 2,000 positions in the Red Cross, some overseas, were unfilled. Qualified instructors in the schools of social work were also in short supply. For the next several years, from 800 to 1,000 new workers fully trained personnel in supervisory positions.

In view of the widespread gap between the number graduating from social work schools and the existing vacancies, and the rapid rise in population, authorities in this field expect the shortage to last for 10 years or longer and to become increasingly severe. This situation has caused agencies to employ persons without professional social work training for nonsupervisory positions and to place fully trained personnel in supervisory positions.

Men hold the majority of positions in the field of probation and parole, in group work, and in community organization. They are in great demand for administrative positions in all agencies, as medical and psychiatric social workers in the Veterans Administration and military hospitals, and in rehabilitation work. The proportion of men in social work is gradually increasing.

Earnings and Working Conditions

The salaries of social workers vary greatly from State to State. In 1956, graduates of professional schools without work experience were paid $3,600 or more as beginning salaries. In some of the larger cities, experienced social workers with 2 or more years of graduate training were paid a median (average) annual salary of $4,345. Child-welfare workers and probation and parole officers were paid slightly less than this average salary

and psychiatric social workers somewhat more.

The Federal Government through its civil service system employs a few college graduates who have had undergraduate training in introductory social work courses at entrance salaries of $3,670. For those with 2 years of training in a professional school of social work, the entrance salary is $4,525; and for those with both 2 years of graduate training and 2 years of experience, the entrance salary is $5,440.

Administrators in public and private agencies with heavy responsibilities may be paid $10,000 or more a year, with salaries reported up to $35,000. Positions in administration and in community organization are usually better paid than other positions, and men generally command higher salaries than women.

The workweek for social workers is usually from 35 to 40 hours. In a few agencies, 24-hour service is maintained so that shifts are rotated among the workers. Social work positions generally provide such benefits as retirement pensions, paid sick leave, and vacations.

Where To Go for More Information

General information on the field of social work, including lists of approved graduate schools, undergraduate colleges, and universities which offer courses of social-welfare content, and available scholarships, may be obtained from:

Council on Social Work Education,
345 East 46th St., New York 17, N. Y.

A series of eight bulletins on the outlook in social work, published by the Women's Bureau of the U. S. Department of Labor in 1950–51, is available in many libraries.

Information on entrance into the public service may be found in the chapter on Government Occupations in this Handbook.

Statisticians

(D. O. T. 0–36.51)

Nature of Work

The charts and graphs displayed in magazines and newspapers, and those hanging on the walls of many business offices usually represent the findings of studies planned by statisticians or by persons with substantial training in statistical methods. Statisticians' work involves the collection and analysis of data on a wide variety of subjects, such as changes in temperature, the financial value of a college education, growth in the yield of corn per acre, increase or decrease in sales, or changes in employment and earnings. Their findings may extend scientific knowledge or provide information needed for government and business planning and administration or in other activities.

Statisticians specialize, as a rule, either in mathematical statistics or in an applied field. Mathematical statisticians develop and test experimental designs, sampling techniques, and analytical methods which lead to more efficient procedures for obtaining and interpreting quantitative information. Applied statisticians use statistical techniques in making studies of specific subject fields. The applied statistician usually remains in his own subject-matter field or in a related field of study, but the mathematical statistician may easily transfer from one field to another.

Because statistics is a tool which is used by specialists in a variety of fields, it is frequently impossible to distinguish people who are primarily statisticians from those who are chiefly subject-matter specialists with a knowledge of statistics. For example, the applied statistician who provides quantitative information on economic conditions may be called an economist, while the one who designs experiments on the growth of animals under different diets and environments may be classified as a biologist. Similarly, the mathematical statistician who develops new statistical methods applicable to all problems which can validly be expressed in numerical terms may be classified as a mathematician. (See statement on mathematicians, p. 134.) Furthermore, clerical workers who perform mathematical computations or prepare charts or tables are sometimes called statisticians. This overlapping of fields makes it difficult to determine the number of statisticians. However, it is broadly estimated that, in 1956, there were about 15,000 professional workers whose major interest was in statistical methods and their application to problems in particular fields. Only a small proportion of these were mathematical statisticians.

Most statisticians are engaged in research or perform administrative or supervisory functions in connection with research programs. Some are employed as college teachers—often combining teaching with research or administrative activities. Others act as consultants.

The research statistician has two main functions: (1) To devise methods of obtaining, classifying, and summarizing quantities of data so as to provide usable information; and (2) to analyze the data and prepare reports on the findings. The design of surveys based on scientifically selected samples is often the statistician's principal task. In planning surveys, statisticians choose the sources from which the needed data can be obtained most readily, draw up questionnaires or report forms, and prepare instructions for collecting the data. They also make plans for tabulating the data, analyze the tabulations, and present the findings in summary tables, charts, and written reports.

Where Employed

The largest employer of statisticians is the Federal Government. Every major Federal agency employs some members of this profession, although more than two-thirds of all statisticians on Federal payrolls are in the Departments of Defense, Commerce, and Agriculture. Private industry employs a large and growing number of statisticians, particularly in market research and quality control work. Colleges and universities are a major source of employment for mathematical statisticians. Other statisticians are employed by State and local governments, nonprofit foundations, and research organizations.

Training and Other Qualifications

Students planning careers as statisticians can obtain the necessary minimum training in many institutions, although only a few colleges and universities grant degrees in statistics. A bachelor's degree with a major in mathematics or economics and a minor in statistics is the most usual educational preparation for an entry job leading to a professional position as a statistician. Essential courses in mathematics include college algebra, plane trigonometry, analytical geometry, and differential and integral calculus. In addition, at least one course in statistical methods is necessary. Advanced courses in mathematics and statistical theory are considered desirable for many jobs and essential for some. Furthermore, all statisticians not qualified as mathematical statisticans need thorough training in some subject-matter field.

The minimum requirements for the position of junior statistician in the Federal Government were, in 1956, a bachelor's degree with 15 semester hours in statistics (or in a combination of mathematics and statistics, including at least 6 semester hours in statistics) and with 9 semester hours in 1 of several subject-matter fields. Many private firms have similar minimum prerequisites for entrance positions. In addition, for many quality control positions, statisticians need engineering training and courses in the application of statistical methods to manufacturing processes. For market research and forecasting work, a major in business administration or a related field is also helpful.

First jobs for inexperienced college graduates with only bachelor's degrees are likely to involve much clerical work. Since this work often requires the use of adding and calculating machines, ability to operate such machines is extremely helpful. In most types of employment, the statistician must also have considerable knowledge of tabulating equipment. Although persons with only bachelor's degrees may be able to advance to more responsible positions on the basis of experience, there is a trend toward requiring further academic training, especially in the subject-matter field, for advancement in analytical and survey work.

The master's degree in statistics or mathematics is required for many entry positions in mathematical statistics and is almost indispensable for promotion to high-level positions in this field. This degree also qualifies the statistican for teaching in a department of mathematics in many colleges and universities. However, a doctoral degree is required for appointment as instructor in some high-ranking institutions and is essential for advancement to a professorship in many colleges. The doctorate is also an asset in obtaining high-ranking administrative positions and consulting work outside the college teaching field.

Employment Outlook

Employment opportunities for well-qualified statisticians are expected to increase substantially

during the remainder of the 1950 decade and during the 1960's. Most of the opportunities will be in industry, but moderate increases are expected also in other types of employment. Statisticians with graduate degrees in mathematical statistics will have the best employment opportunities.

In 1956, the demand for statisticians was very strong and shortages were reported in many specialized fields, particularly in mathematical statistics. Persons with broad training in mathematics and statistics and a knowledge of engineering or the physical sciences were in demand for many types of work, including quality control and programming for electronic computing equipment. Increased Federal appropriations for agricultural marketing and rural development research programs created new opportunities for agricultural statisticians both in the Federal Government and in State agricultural experiment stations. In the long run, employment of statisticians will probably increase at least as fast as employment in professional occupations as a group.

Mathematical statisticians with graduate training will be in demand in private industry to aid engineers in designing experiments and in developing methods of testing new equipment, in production quality control work, and in operations research. It is anticipated that companies will also rely more and more on the work of statisticians in analyzing and forecasting sales and business conditions and in modernizing their accounting procedures. With the growing use of electronic computing machines, there will be an increasing demand for statisticians who are able to plan work so as to make the most efficient use of such equipment.

The number of teachers of statistics is also expected to rise, owing to increasing college enrollments (see statement on college teachers, p. 63) and because many colleges are likely to offer more courses in statistics as the importance of statistical training in other fields of study becomes more widely recognized. The number of statisticians in government agencies is also likely to rise moderately. Additional personnel are expected to be needed to analyze the increasing amount of statistical data available on the operations of expanded programs in such fields as social security, health, and education; also, a large number will continue to be employed in long-term programs involving collection of economic data of many kinds. In addition to those needed for expansion in employment, several hundred statisticians will be required yearly to replace those who resign, retire, or die.

Earnings and Working Conditions

Men college graduates with good training in statistics generally have about the same entrance salaries in private industry as other college graduates employed as business trainees. Women graduates who have specialized in statistics generally receive higher entrance salaries than women college graduates in most other professional fields. Beginning salaries for men graduates with a major in statistics averaged about $350 a month in private industry in 1956; for women, entrance salaries averaged about $330.

Beginning salaries for statisticians in the Federal Government were $3,670 a year in 1956 for inexperienced graduates with only a bachelor's degree and $4,525 for those with the master's degree or its equivalent in education and experience.

Statisticians earn more, on the average, than persons working in the closely related social science fields. A 1952 survey of the earnings of social scientists indicated that the median (average) annual salary of statisticians was $6,800, somewhat higher than the median for economists ($6,500) and much higher than the comparable figures for other social science fields. Salaries of statisticians, like those of other professional workers, have risen substantially since 1952.

Where To Go for More Information

Additional information on employment trends and on educational requirements for statisticians is given in the following publications:

Employment Outlook in the Social Sciences. Bureau of Labor Statistics Bull. 1167, 1954. Superintendent of Documents, Washington 25, D. C. Price 30 cents.

Educational Requirements for Employment of Statisticians. Veterans Administration Pamphlet 7–8.9, 1955. Superintendent of Documents, Washington 25, D. C. Price 15 cents.

Information on the characteristics and earnings of statisticians is contained in the following report on a statistical survey:

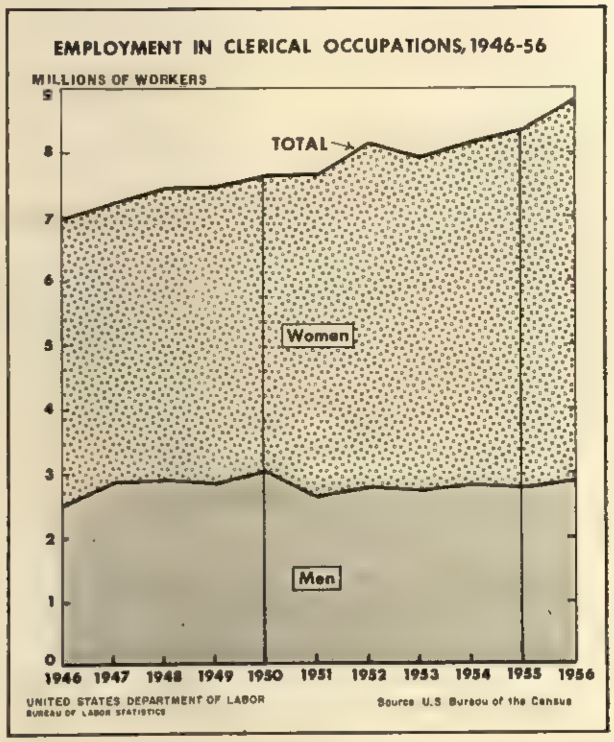
Personnel Resources in the Social Sciences and Humanities. Bureau of Labor Statistics Bull. 1169, 1954. Superintendent of Documents, Washington 25, D. C. Price 70 cents.

Clerical, Sales, and Service Occupations

Clerical Occupations

The clerical workers who take care of the vast amount of correspondence, recordkeeping, and other office duties necessary to the operation of modern businesses and government agencies are one of the largest occupational groups in the United States. About 1 out of every 8 persons at work in the country in 1956 was in a clerical or closely related job. Altogether, about 9 million men and women were employed in occupations classified by the Bureau of the Census as "clerical and kindred." (See chart 30.)

CHART 30



Nature and Location of Clerical Work

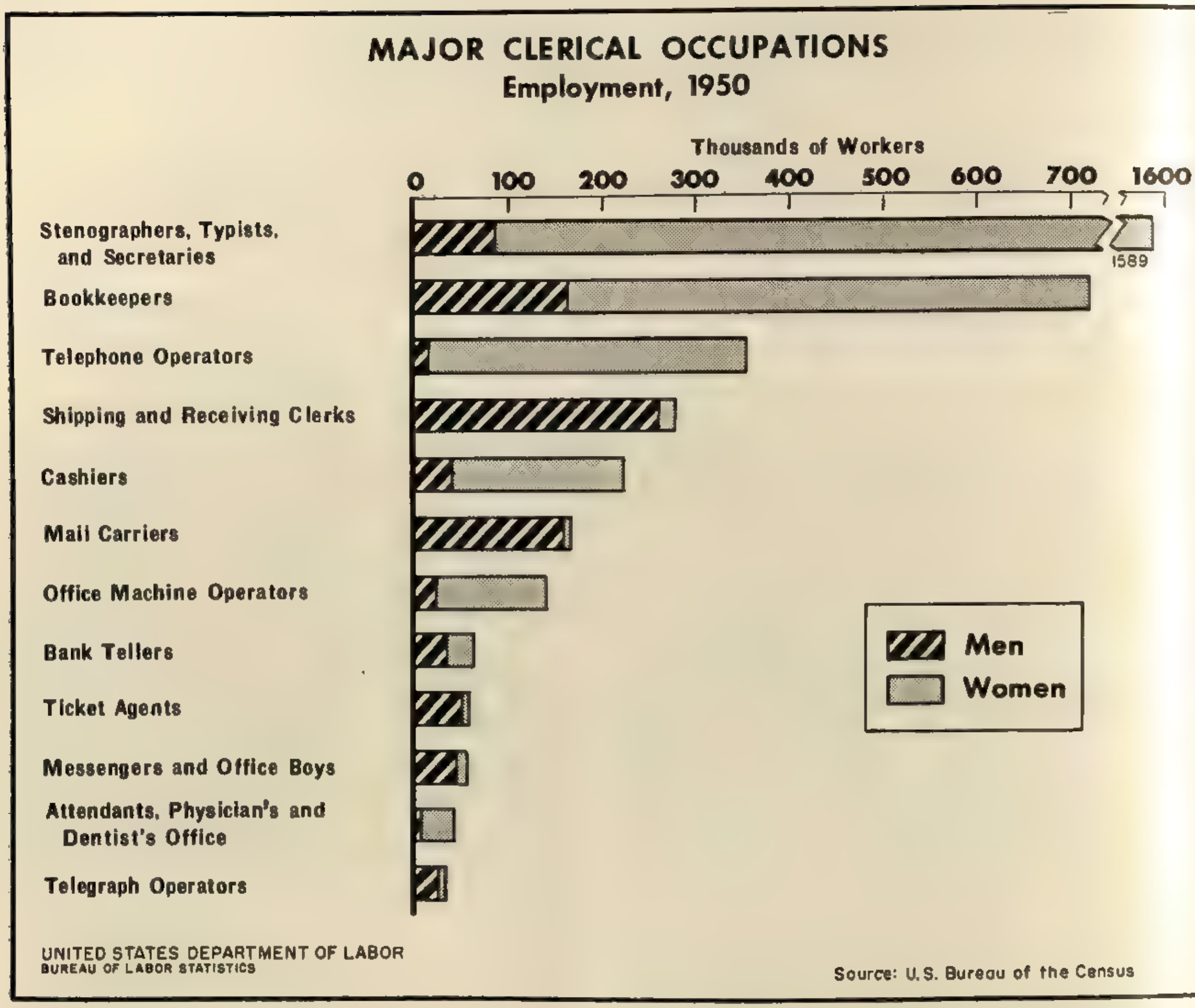
The major clerical occupations are shown in chart 31. Stenographers, typists, and secretaries—by far the largest group of clerical workers classified separately by the Census—totaled about 1½ million in 1950. Bookkeepers were the second largest group with more than 700,000 workers. Other clerical occupations with more than 100,000 workers each include those of telephone operator, shipping and receiving clerk, cashier, mail carrier, and office-machine operator.

Many officeworkers are designated simply as "clerks." There are also large numbers in clerk positions with more specific titles which indicate the type of work done—for example, file clerk, billing clerk, credit clerk, time clerk, payroll clerk, or postal clerk. These clerks and many others who were not classified separately by the Census made up more than one-third of all clerical employees in 1950.

Clerical work is the largest of all areas of employment for women.

Clerical work is the largest of all areas of employment for women. In 1956, about 1 out of every 4 employed women was an office worker. The number and proportion of women in clerical occupations have been rising steadily over the years. Women outnumbered men in these occupations for the first time in 1940, and by 1956, two-thirds of all clerical workers were women. More than 90 percent of the telephone operators; the stenographers, typists, and secretaries; and the attendants in physicians' and dentists' offices are women. Women also fill more than three-fourths of the jobs as bookkeepers, cashiers, and office-

CHART 31



machine operators. Only in one large occupation—office-machine operator—was there a rise from 1940 to 1950 in the proportion of men employed. Nevertheless, about 3 million men were employed in clerical and related work in 1950. More men than women were working as shipping and receiving clerks, mail carriers, bank tellers, ticket agents, messengers, and telegraph operators, as well as in many smaller occupational groups such as vehicle dispatchers, bill collectors, railway mail clerks, and baggagemen.

Clerical workers are employed in all industries, since some office work is essential in nearly every business. However, an increasing proportion of clerical workers are employed in finance, service, and related industries—principally in banks, in insurance and real estate companies, and in professional and business services. More than one-fourth of all officeworkers were employed in this group of industries in 1956, whereas only a little more than one-fifth of such workers were employed in manufacturing. Wholesale and retail trade, government, and transportation, communication, and other public utilities also employed large numbers of clerical workers.

Clerical jobs are to be found in the smallest of towns—everywhere that business is carried on. However, the great concentration of employment is in the largest cities where the central offices of insurance companies, banks, and corporations are located or where large government offices are established.

Training and Other Qualifications

Graduation from high school is the usual minimum educational requirement for entering clerical jobs. Additional business courses or some college work may be required for jobs requiring specialized skill. The most widely sought office skills—stenography and typewriting—may be obtained either through high school or business school courses. Ability to do some typewriting is an asset in qualifying for most types of clerical work. The operation of many kinds of office machines, such as adding machines, special bookkeeping machines, and billing machines, is often taught on the job. A good many large firms offer training courses in the use of equipment such as telephone switchboards, dictating machines, or electric typewriters, and a few firms finance business school training for employees on company time if they agree to stay on for a stated period of employment. Many companies participate in work-study programs with local high schools; pupils who have been in such programs usually are given preference when seeking employment. Some employers give aptitude and other tests to applicants for office jobs. Reading comprehension, numerical skill, and good knowledge of spelling and grammar are important in obtaining a job and essential to advancement. A good personality and ability to get along with others are rated high in qualifications necessary for success in office work.

College graduates often enter clerical occupations to gain experience in a particular industry or business and later work up to professional or administrative positions. Young people who enter with little education may never advance far and may leave for other types of jobs. However, companies often prefer to hire people with only minimum qualifications for clerical positions, since they are more likely to be satisfied with and remain on jobs of a routine nature than are persons with more advanced training.

Promotion from a beginning clerical job may be first to a minor supervisory position and then to that of section head. Many preferred jobs—secretary, information clerk, customer relations clerk, and others requiring a general knowledge of company policies and procedures—are frequently filled by promotion from the ranks of clerks and typists. Although seniority is an important consideration in selecting clerks for promotion and transfer, emphasis is also placed on the individual's ability and personal qualifications for the new job.

Employment Outlook

Large numbers of openings will occur each year in clerical occupations. Most of the employment opportunities will result from employee turnover, which is exceptionally high in this field. A 1955 survey of several hundred firms with office staffs ranging from fewer than 50 to more than 1,000 workers indicated an average annual turnover rate of 40 percent, about half of which resulted from young women leaving their jobs to marry or care for their children. In addition to the many jobs expected to become available because of continuing high replacement rates, a number of new opportunities are likely to result from employment growth.

The shortage of clerical workers—particularly of stenographers and secretaries—which had been evident in most cities for several years was still pronounced in 1956. Many business firms were hiring people who in previous years when more workers were available would have been considered unsuited for office work. These included persons in the older age groups, high-school-age youths, and handicapped workers; many were employed on a part-time basis. In general, employers were well pleased with these workers and are likely to continue to recruit from their ranks. The extensive use of older women is indicated by the rise in the median age of women office workers from 31 years in 1951 to 33 years in 1956.

A rapid rise in the number of clerical workers and in the proportion these workers represent of the total working force has been a marked feature in the growth of American industry over the years. In 1910, only 1 in 20 American workers was engaged in clerical work. By 1940, the proportion of clerical workers had risen to 1 in 10 and, in 1950, it was 1 in 8 employed workers. In 1956, the proportion of clerical workers was a little higher than in 1950.

The remarkable increase in employment of clerical workers has taken place despite—sometimes even because of—the introduction of new labor-saving equipment and more efficient management methods. For example, the dial telephone, far from slowing down the growth in the number of

telephone operators, stimulated the use of telephone services and increased the demand for telephone operators, so that their numbers rose faster between 1940 and 1950 than the number of clerical workers as a group. Similarly, the introduction of electric typewriters, duplicating equipment, machines to take dictation, and other improvements in methods of writing and copying letters and reports failed to halt the rise in employment of secretaries, stenographers, and typists whose number rose by 50 percent between 1940 and 1950. Only in a few small clerical occupations, such as bill collector, messenger, and telegraph operator, was there a decline in numbers during this decade.

Underlying this growth has been the tremendous increase in the size and complexity of business organizations, which has added greatly to the volume of recordkeeping and communication required. Centralized management services have been established to aid in the control and coordination of these enlarged organizations, and this has brought about expansion in such areas as advertising, research, accounting, personnel administration, insurance, and employee benefits. These activities have added vastly to the amount of paperwork involved in business management. At the same time, the greater volume of tax and other reports to government agencies further increased the amount of office work required of industry, and has also greatly increased clerical work in government offices.

In the near future and over the long run, clerical employment is likely to continue to rise owing to the same factors that have brought about previous increases. However, industry has begun to make a determined attack on the problem of clerical costs and is introducing new equipment designed to handle a rising volume of work without a corresponding increase in the number of clerks required. A few large insurance companies, banks, and industrial firms had already installed electronic data processing equipment by 1956 and thereby reduced their need for clerks in many routine operations. Although these machines have created a number of new jobs, many of which require considerable skill and are relatively well paid, their net effect is a reduction in the number of clerical workers needed to perform a given volume of work. However, electronic data processing machines are expensive and complicated and it will doubtless take a number of years before they are widely used, even in the very large organizations able to buy and effectively use them. It is probable that a more important factor affecting employment of clerical personnel will be the more widespread use in small firms of the less expensive types of office equipment, such as improved bookkeeping machines, calculators, adding machines, and photographic and other duplicating equipment. Whereas the use of these machines increases the employment of certain types of office personnel (mainly office-machine operators), their net effect is the accomplishment of more work with fewer people.

Taking into account the basic growth factors in the clerical field and the efforts of business to reduce clerical costs by the use of more automatic equipment and other means, it appears likely that employment in clerical occupations will continue to increase, but at a slower pace than during the past several decades. There is already some evidence of a slowing down. If the number of clerical workers had continued to rise as rapidly after 1950 as it did in the previous decade, the total number of clerical workers in 1956 would have been nearly 10 million, compared with an actual total of somewhat less than 9 million. Furthermore, the rise in the number of clerical workers has been due in part to increased employment of part-time workers. For example, between October 1955 and October 1956, more than three-fourths of the increase in total employment was accounted for by part-time workers.

Employment opportunities in the clerical field may be greatly affected by changes in the level of business activity. There are usually plenty of people in the labor force with the qualifications needed for most office jobs. However, the comparatively low salaries offered limit the number of applicants when other jobs are available. On the other hand, when business activity declines keen competition is likely to develop, since the supply of workers available for clerical employment is increased by displaced workers from many other occupations.

Earnings and Working Conditions

The most common hiring-rate range for inexperienced clerical workers, including typists, was from $40 to $42.50 a week in the winter of

1955–56, according to a survey of earnings in 17 labor market areas by the U. S. Department of Labor's Bureau of Labor Statistics. The highest paid officeworkers were men classified as accounting clerks (class A) whose average weekly salaries ranged from $75 to $95.50 a week. Among women office workers, secretaries were generally the highest paid, with salaries ranging from an average of $61.50 in Providence, R. I., to $81 in Detroit, Mich. Accounting clerks (class A) usually were the second highest paid among women officeworkers. Average salaries of women in the major office occupations in the 17 labor market areas surveyed are shown in table 1.

TABLE 1.—*Average weekly salaries for women in 14 office occupations, 17 areas, winter 1955–56*

Area	Book-keeping machine operators, class A	Book-keeping machine operators, class B	Clerks, accounting, class A	Clerks, accounting, class B	Clerks, file, class B	Clerks, payroll	Comptometer operators	Key-punch operators	Office girls	Secretaries	Stenographers, general	Switchboard operators	Typists, class A	Typists, class B
Northeast:														
Newark–Jersey City	$62.00	$54.00	$71.50	$58.50	$47.50	$63.50	$63.50	$58.50	$45.00	$75.50	$61.50	$59.50	$58.50	$51.00
New York City	66.00	59.00	73.50	58.50	49.00	68.00	63.50	57.50	46.00	78.50	63.00	62.00	61.50	53.50
Philadelphia	61.00	49.00	64.00	52.00	41.00	58.50	54.50	54.00	41 00	70.50	56.50	55.00	54.00	46.00
Providence	56.00	49.50	58.50	49.50	42.50	52.50	51.00	49.00	42.00	61 50	51.50	50.50	50.50	45.00
South:														
Atlanta	60.00	54.50	68.00	53.50	44.50	58.50	57.00	53.50	44.50	71.00	59.50	48.00	53.50	47.00
Dallas	62.50	51.50	64.50	54.00	40.50	58.50	56.50	52.50	41.00	70.00	60.50	48.50	54.00	46.50
Memphis	60.00	51.00	64.00	51.00	42.50	56.50	51.50	53.00	42.50	62.50	54.00	41.50	54.00	43.50
New Orleans	58.00	46.50	68.00	50.50	41.50	54.00	51.00	52.00	36.50	67.50	54.50	42.00	49.50	42.00
Middle West:														
Chicago	73.50	62.00	76.00	61.00	51.00	68.50	65.50	63.50	51.50	78.50	66.50	62.50	65.00	55.50
Detroit	73.00	58.50	78.00	60.50	48.50	70.50	67.00	64.50	49.50	81.00	69.50	63.00	67.00	53.50
Milwaukee	66.00	54.50	69.50	56.00	46.50	59.50	55.50	55.00	43.50	74.50	58.50	53.00	58.00	48.50
Minneapolis–St. Paul	62.00	52.00	66.50	52.00	44.00	59.00	57.00	50.50	41.50	68.50	56.50	55.00	54.00	47.50
St. Louis	61.50	53.00	70.00	54.00	45.50	60.50	58.00	57.00	47.00	73.00	59.00	55.50	58.50	49.50
Far West:														
Denver	65.50	51.50	63.50	55.00	45.50	59.00	54.00	56.50	43.00	70.50	59.50	50.50	55.50	48.50
Los Angeles–Long Beach	75.00	57.00	76.00	64.00	52.00	72.50	68.50	67.50	52.00	79.50	68.00	63.00	64.00	55.00
Portland	69.50	55.50	74.00	60.50	48.00	64.00	61.00	62.00	45.50	75.00	63.00	53.50	60.00	51.00
San Francisco–Oakland	74.00	58.50	75.00	62.00	50.00	71.00	65.00	63.00	52.00	79.00	68.50	63.00	62.00	54.00

SOURCE: U. S. Department of Labor, Bureau of Labor Statistics.

Officeworkers in Detroit and in the Los Angeles–Long Beach area received the highest average salaries, about 6 percent more than the salaries paid in New York City. New Orleans officeworkers received the lowest salaries, on the average—about 20 percent less than those in New York City.

Pay levels for office workers tend to be higher in manufacturing than in most nonmanufacturing industries. However, salaries in public utilities frequently exceed those in manufacturing establishments.

The most usual work schedule for full-time officeworkers in the cities surveyed was a 5-day week of 40 hours. About two-thirds of the women office workers in finance, insurance, and real estate offices worked less than 40 hours a week. In New York City, where a high proportion of all clerical workers are employed in such offices, 7 out of 8 women officeworkers had a workweek of less than 40 hours—most typically 35 hours.

Officeworkers usually receive at least 6 paid holidays a year and 2 weeks' paid vacation after a year's employment. Related benefits usually include life insurance, hospitalization and surgical insurance, pay continuation in case of accident or illness, and some type of retirement pension plan.

Where To Go for More Information

Information on clerical workers in different fields of employment is given in the chapters on various industries—especially those on the banking, insurance, and telephone industries—and in the chapter on Government Occupations. (See index.)

Information on training is available from:

U. S. Department of Health, Education, and Welfare, Office of Education, Guidance and Student Personnel Section, Washington 25, D. C.

United Business Education Association, (A department of the National Education Association) 1201 16th St., NW., Washington 6, D. C.

Information on private business schools may be obtained from:

National Association and Council of Business Schools, 601 13th St., NW., Washington 5, D. C.

Bookkeepers

(D. O. T. 1–01.02, 1–01.03; 1–02.01, .02, .03)

Nature of Work

Jobs in bookkeeping range from entry positions as clerk or machine operator to the highly responsible post of head bookkeeper. Bookkeeping clerks perform routine tasks such as recording and posting items by hand; in small businesses, they may also perform related duties such as typing, filing, answering the telephone, and mailing statements. Bookkeeping-machine operators may use relatively simple machines to record only one type of data or may operate complicated machines that record a great variety of information. General bookkeepers, who are employed chiefly in small establishments, keep complete and systematic records of their employers' business transactions, recording items in journals and on special forms, posting ledgers, balancing books, and compiling reports. In large establishments which employ many office workers, a bookkeeper may have charge of one section of the records, such as accounts payable or accounts receivable. The head bookkeeper in a large office has responsibility for all aspects of his department's work.

Where Employed

About 800,000 workers were employed as bookkeepers in 1956; more than three-fourths of them were women. Well over one-third of all bookkeepers are employed by wholesale and retail trade establishments, one-fifth by manufacturing firms, and about one-sixth by finance, insurance, and real estate firms. Substantial numbers are employed also by public utility firms, business and professional services, and construction companies.

Training and Other Qualifications

Most employers require applicants to be graduates of high schools, business or vocational schools or, in some instances, of junior colleges. A business course which includes training in many office functions such as typing, shorthand, and the use of adding and other office machines, as well as business arithmetic and bookkeeping procedures, will usually be especially helpful in obtaining a bookkeeping job, particularly in a small office. An increasing number of large companies offer some on-the-job training or participate in cooperative programs, under which high school students obtain school credit for part-time work. Experience of this kind is of considerable advantage in obtaining full-time employment after graduation. Positions as head bookkeepers usually require either education in accounting or extensive experience.

Employment Outlook

Many employment opportunities for bookkeepers are expected during the remainder of the 1950's and the early 1960's. In this large occupation with its high proportion of women, the rate of turnover is very great. There is constant demand for new employees to replace young women who leave after a few years of employment to take care of their families. In addition, a moderate number of new jobs will become available as the field continues to expand. However, the trend toward breaking down bookkeeping functions into office-machine operator and other routine clerical jobs is likely to continue, and the vast majority of openings will be in such jobs. Employment opportunities for bookkeepers who are required to assume responsibility for a complete set of books will probably continue to be good, although such jobs will be relatively few in number and will generally be filled by promotion from within or by persons with accounting training or experience. The great majority of openings for hand bookkeepers will be in relatively small offices.

Over the long run, the growth in the number of bookkeepers is likely to be slowed down markedly because of the increasing use of office machines. The more extensive use of bookkeeping machines and related equipment in small firms and the further introduction of electronic computers in very large offices will make possible a very great increase in the amount of work performed, with little if any increase in the number of bookkeepers. Nevertheless, some new jobs for bookkeepers will rise each year because of such factors as the growing emphasis on scientific management in industry, increasingly complex tax systems, and the general growth of the economy. (See also statement on accounts, page 159.)

(Information on *Earnings* and *Where To Go for More Information* is given in the introduction to this chapter.)

Secretaries, Stenographers, and Typists*

(D. O. T. 1–33; 1–37.12, .14, .18, and .32)

Nature of Work

More women are employed as secretaries, stenographers, and typists than in any other field of work. Over 1½ million persons, of whom 95 percent were women, were engaged in this work in 1950, and since then the number has increased considerably.

Typists spend a major portion of their time in typing copies of printed or written materials. This work may range from simple copying to the typing of complex tables and manuscripts. In addition, many typists perform such other clerical duties as filing, recording information in longhand, sorting mail, and operating calculators, tabulators, and duplicating and other office machines.

Stenographers, besides typing, take dictation in shorthand; a small number use a stenotype machine. A few stenographers become specialists in foreign languages, legal or police work, or public or court stenography. Court reporters must be able to record accurately difficult technical language at high rates of speed for several hours at a time.

Secretaries also have stenographic duties, but, in addition, they usually handle many business details for their employers on their own initiative, such as acknowledging correspondence, scheduling appointments and meetings, and obtaining information. Some secretaries specialize in legal, medical, private, social, or other types of secretarial work.

Many secretaries and stenographers also use voice recorders from which they transcribe dictation.

Where Employed

Typists, stenographers, and secretaries are employed by practically every kind of business in the United States, as well as by government, religious and social organizations, and other nonprofit groups. In 1950, in the United States as a whole, almost 8 out of 10 of these workers were private wage and salary workers; nearly 2 out of 10 were in government jobs; and the remainder were self-employed or unpaid family workers. Though typists, stenographers, and secretaries are employed in urban centers throughout the country, in 1950, approximately 6 out of 10 such workers were located in the Northeast and North Central regions.

Training and Other Qualifications

Typists must have training not only in typing but also in spelling, vocabulary, punctuation, grammar, and correspondence procedures. Secretaries and stenographers must have, in addition to the typist's skills, the ability to take dictation quickly and accurately. The following table shows some generally acceptable average working speeds:

Class of worker	Words per minute		
	Dictation	Transcription	Typing
Beginning stenographer	80–100	25–35	40–50
Senior stenographer	100–140	35–40	50–60
Court reporter	150 or more	55–65	70–80
General or clerk typist			40–55
Technical typist			50–65
Dictating machine typist			45–65

Completion of a business course in high school, junior college, or business school often satisfies the basic requirements for entrance into this field. For the better paid positions, particularly those classified as secretarial, additional training in business subjects and on-the-job experience are usually necessary. The ability to use office machines, such as voice recorders, calculators, or tabulators, is helpful for many jobs. Many positions require a knowledge of the terminology of a particular field, such as law, medicine, or engineering, or the ability to use a foreign language.

Persons working as secretaries, stenographers, and typists have good possibilities for advancement to higher level positions. A typist with training and ability in shorthand may advance to a stenographic job. A typist may also become an expert operator of one or more office machines that require special skill. Stenographers may advance to positions as secretaries, administrative assistants, office supervisors, or operators of one or more

*Prepared by the Women's Bureau, U. S. Department of Labor.

special office machines. A secretary can become an executive secretary or an administrative assistant, or fill other advanced positions requiring the employee's specialized knowledge of the particular industry or business. Frequently, advancement for typists, stenographers, and secretaries comes in the form of greater responsibilities and higher salaries without any change in job title. Furthermore, some of today's successful business people started their careers as stenographers or typists and advanced to highly responsible positions after extensive experience in a particular type of business.

Employment Outlook

High school graduates with typing skills were in great demand in most areas of the United States in 1956. Competition was keen for the services of stenographers in most metropolitan areas. Openings for secretaries, however, have generally been fewer in number than openings for typists and stenographers. Since many secretarial positions are filled by promotion from stenographic and typing positions within the same organization, the number of such vacancies that reach the open market is somewhat restricted.

A shortage of competent secretaries, stenographers, and typists has existed in many areas since World War II. The continued high level of economic activity has necessitated expansion in this field of work, as in others. In addition, numerous job openings are created because many young women leave the labor market to assume family responsibilities.

In the long run, employment will continue to rise because of continued expansion of private business and government activities. Since turnover rates will probably remain high among the young women in the field, there will be many job opportunities. Stenographers and secretaries will probably continue to have a wider choice of jobs than persons with only typing skills.

Stenographic and typing positions generally offer steady employment. Unless there is a major decline in economic activity, these workers are usually assured of jobs.

Earnings and Working Conditions

Earnings of secretaries, stenographers, and typists are greatly influenced by the location of the job, the size and type of the business, the responsibility or skill level required, and the length of the workweek. Average weekly salaries of women secretaries, stenographers, and typists, according to a 1955–56 survey by the Bureau of Labor Statistics of office workers in 18 metropolitan areas, are shown in the following table:

Metropolitan area	Secretary	Stenographer		Typist	
		General	Technical	Class A	Class B
Atlanta, Ga	$71.00	$59.50	------	$53.50	$47.00
Chicago, Ill	78.50	66.50	$73.00	65.00	55.50
Dallas, Tex	70.00	60.50	------	54.00	46.50
Denver, Colo	70.50	59.50	66.00	55.50	48.50
Detroit, Mich	81.00	69.50	81.00	67.00	53.50
Lawrence, Mass	67.00	54.50	------	------	43.00
Los Angeles, Calif	79.50	68.00	79.50	64.00	55.00
Memphis, Tenn	62.50	54.00	------	54.00	43.50
Milwaukee, Wis	74.50	58.50	------	58.00	48.50
Minneapolis–St. Paul, Minn	68.50	56.50	------	54.00	47.50
New Orleans, La	67.50	54.50	------	49.50	42.00
New York, N. Y	78.50	63.00	72.50	61.50	53.50
Newark–Jersey City, N. J	75.50	61.50	66.00	58.50	51.00
Philadelphia, Pa	70.50	56.50	66.50	54.00	46.00
Portland, Oreg	75.00	63.00	------	60.00	51.00
Providence, R. I	61.50	51.50	59.50	50.50	45.00
San Francisco, Calif	79.00	68.50	------	62.00	54.00
St. Louis, Mo	73.00	59.00	64.00	58.50	49.50

In the Federal Civil Service in 1956, typists could secure jobs with annual starting salaries of $2,960 or $3,175, depending upon the difficulty of the job. For stenographers, annual starting salaries were $2,960, $3,175, and $3,415, again depending upon the difficulty of the assignment.

A workweek of less than 40 hours is customary in many offices. In 17 of the 18 metropolitan areas covered by the 1955–56 survey, secretaries, stenographers, and typists worked an average of 38 to 40 hours a week; in one area, the average was 36 hours.

Two weeks' paid vacation each year, after the first year of service, is usual in private industry. Some firms provide 1 week of paid vacation during the first year of employment and many firms provide 3 weeks of paid vacation after 15 years of service.

Office workers also receive a number of holidays with pay. National holidays are usually

granted, and some workers are given State and local holidays.

A substantial number of employers provide group insurance for their office work force. In some instances, the premium cost is paid by the employer; in some, the cost is shared by employee and employer; and in others, the entire premium is paid by the employee. Insurance coverage may be sickness and accident, hospitalization, life, or a combination of these.

Retirement or pension plans are also becoming more common in private industry. In 1956, from 50 to 84 percent of all office workers in the 18 major metropolitan areas studied were employed in firms with retirement or pension plans.

Where To Go for More Information

Information may be secured from:

The National Secretaries Association,
222 West 11th St., Kansas City 8, Mo.

Office Employees' International Union,
1012 14th St., NW., Washington 5, D. C.

Training information is available from:

United Business Education Association (a department of the National Education Association),
1201 16th St., NW., Washington 6, D. C.

Information about private business schools may be obtained from:

National Association and Council of Business Schools,
601 13th St., NW., Washington 5, D. C.

Sales Occupations

Sales workers are the link between producers of goods or services and the people who use them. The things they sell include all items produced by American business—houses, airplanes, sheet steel, industrial machinery, gasoline, clothing, food, insurance, stocks and bonds, needles, and pins, to cite a few illustrations from a virtually endless list. Their customers include not only housewives and other individual consumers but also government agencies and business enterprises of all kinds.

Among the many different types of sales workers are manufacturers' sales representatives who sell to wholesalers, other manufacturers, and retail stores; wholesale salesmen, who sell to retail stores; insurance agents and real estate salesmen, who sell both to business organizations and to individuals; newsboys, including those delivering papers to homes; and salesmen and saleswomen employed by retail businesses such as food, department and apparel stores, service stations, and automobile agencies. (See chart 32.) Altogether, more than 4 million workers were employed in sales occupations in 1956.

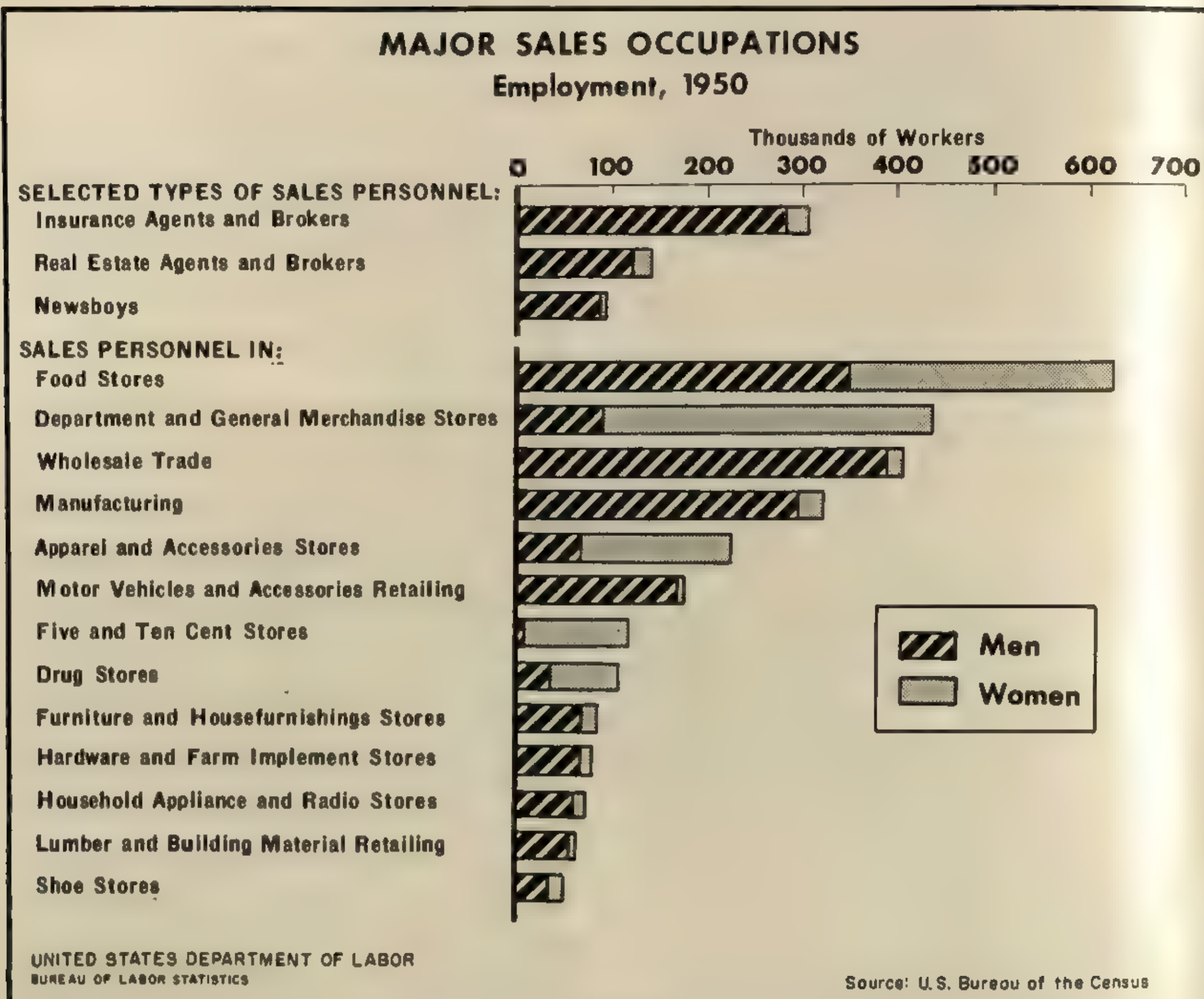
Nature of Work and Training

Because of the wide variety of products sold and the many different classes of consumers that buy them, sales jobs differ greatly as to duties, knowledge and level of education required, and personal characteristics needed. There is, likewise, a very great range in earnings among the different types of sales positions.

Sales clerks in retail trade are by far the largest group of sales workers, representing more than 60 percent of the total number in 1950. Some salespersons in stores—for example, those selling furniture or major electrical appliances—must know a great deal about the merchandise they sell. However, most sales clerks merely display merchandise, assist the customer in making a selection, and receive payment or make out a charge slip. In some branches of retail trade, such as five and ten cent stores, persons without high school diplomas find opportunities as sales clerks. However, high school graduation is now being required to an increasing degree for the better selling jobs in department and many other types of stores. (See chapter on Department Store Occupations.)

Salesmen working for manufacturers or wholesalers must usually have a thorough knowledge of the products they sell and know how each product can meet the needs of their customers. In many jobs, especially in the manufacturing field, technically trained men such as engineers, chemists, and pharmacists are required. Training courses in sales techniques are given new salesmen by most large companies, and courses in salesmanship are offered by many universities. In addition, at least several years of experience are usually required to become fully established as a salesman in this area of work. Many of these salesmen must travel extensively and be away from home much of the time. Most work on a commission basis, rather than on straight salary, and conse-

CHART 32



quently their earnings may vary considerably from month to month or from year to year, depending on business conditions and other factors.

Insurance agents and brokers must be able to pass a qualifying examination and obtain a State license before they can sell insurance of any type. Most States also require real estate agents and brokers to obtain a license. Both of these growing occupations require mature personnel with a high degree of selling ability. (See chapter on Insurance Occupations.)

The job of newsboy is unique in sales work because it is the only occupation in the field which affords employment primarily for children. It is usually a part-time job conducted on a neighborhood basis. More than half of the nearly 100,000 newsboys employed in 1950 were under 16 years of age.

The position of advertising salesman or agent is still another example of the many different types of jobs to be found in the sales field. Advertising salesmen are employed primarily by advertising agencies and publishing companies, but increasing numbers are employed as program-time salesmen for radio broadcasting and television companies.

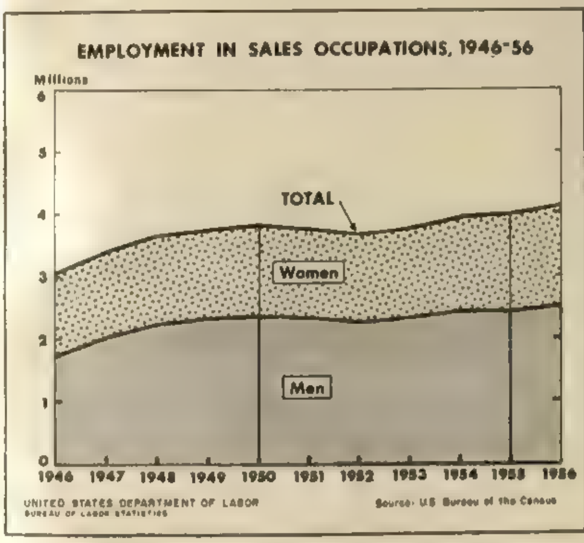
Although men predominate in the sales field—particularly in such areas as wholesale trade, manufacturing, insurance, and real estate—selling is becoming an increasingly important source of employment for women. Within retail trade, more saleswomen than salesmen are employed in the following types of stores: five and ten cent, department and general merchandise, apparel and accessories (except shoes), drug, jewelry, and florist. On the other hand, men constitute a majority of the sales force in retail establishments

selling automobiles, lumber, fuel, hardware, gasoline, household appliances and radios, furniture and housefurnishings, liquor, and shoes.

Employment Outlook

A rise in employment of sales personnel is anticipated over the long run, but the rate of growth is uncertain. Employment in sales occupations rose by a fourth between 1940 and 1950 and by 8 percent between 1950 and 1956—about as fast as the rise in the labor force as a whole over the 16-year period. (See chart 33.) However, much of the increase in employment during this period was the result of hiring more women part-time workers—most of them for jobs in retail trade—and of a shortening of the standard workweek. The total number of man-hours worked by sales personnel undoubtedly increased much less than the number of sales workers employed. Employment also rose much more slowly than retail sales—since greater use of self-service techniques and other improvements in sales procedures and equipment have enabled many stores to handle more business without a proportionate increase in their sales force.

CHART 33



These factors will probably continue to limit the growth of retail sales employment in the future. However, in view of the long-run upward trend in retail sales, some further gains in employment of sales personnel are likely, so long as the general level of economic activity remains high. Much of the growth will take place in expanding suburban communities, as new or branch stores of various types are opened to meet the needs of local areas.

Employment is also expected to rise in the expanding fields of insurance and real estate. In addition, young men with engineering and other technical training will continue to be in strong demand as salesmen for manufacturers and wholesalers. The increasing complexity of much of the equipment sold to industry makes it necessary to use highly trained technical salesmen to aid customers in learning to use equipment and to adapt it to their needs.

In the future as in the past, most of the job openings for sales workers will occur as a result of turnover. Each year thousands of employment opportunities will arise—especially in retail trade—from the need to replace salesmen and saleswomen who transfer to other jobs or drop out of the labor market.

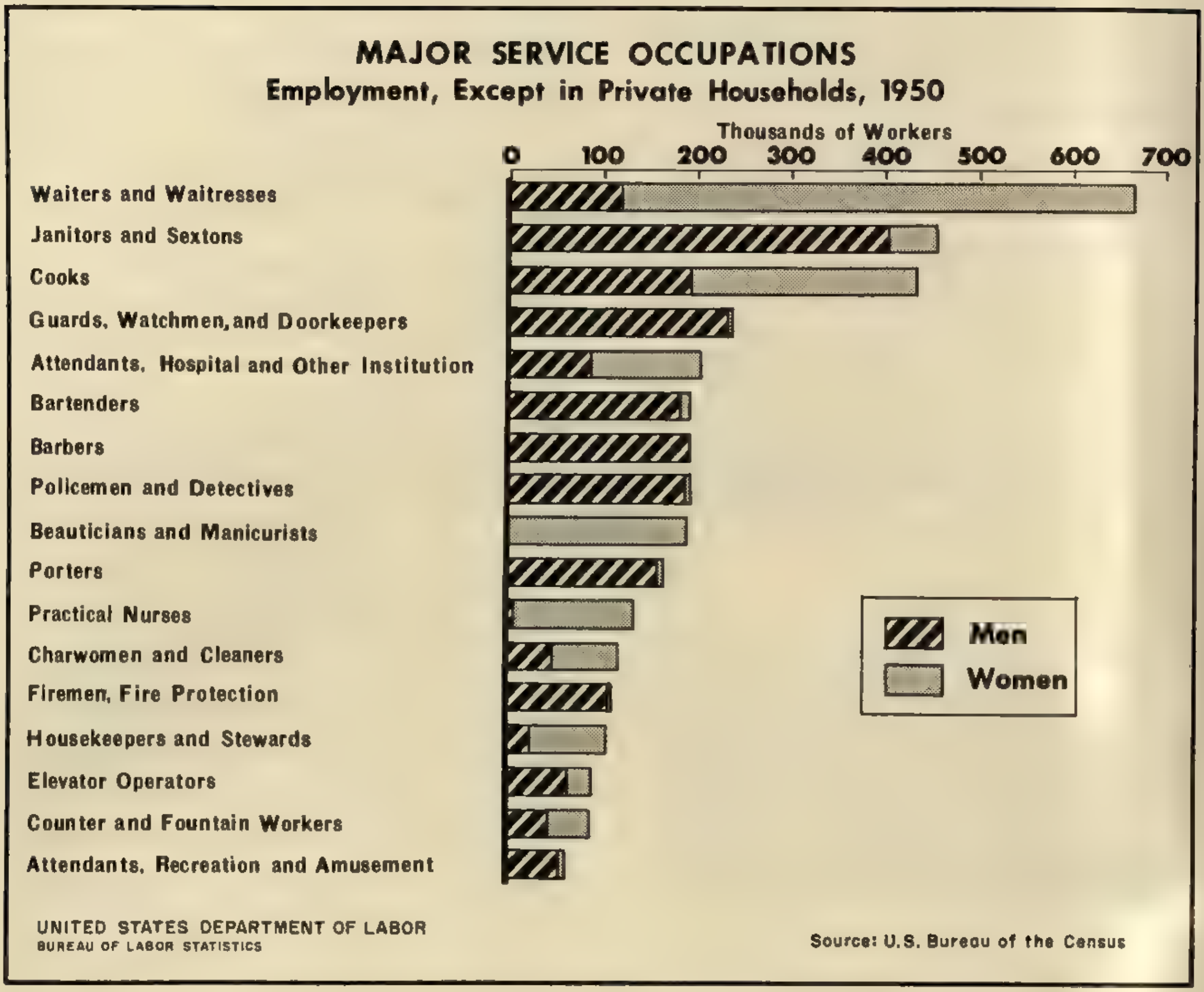
Service Occupations

About 7½ million workers were employed in service occupations in 1956. Included in this total were domestic service workers in private households; workers who provide protection to life and property, such as firemen and policemen; personal service workers, including barbers, beauticians, and practical nurses; and institutional service workers, such as janitors, waiters, cooks, and elevator operators. (See chart 34.)

Service occupations should not be confused with service industries. Service industries—which include hotels, automobile repair shops, amusement enterprises, and advertising agencies—employ not only workers in service occupations but also many professional, clerical, and skilled workers, such as mechanics, copywriters, actors, and stenographers. On the other hand, many workers in service occupations are employed outside the service industries; janitors in factories and porters on railroad trains are examples of service occupations found in manufacturing and in transportation industries.

Many service occupations require considerable

CHART 34



skill and training; others are comparatively unskilled. Protective service jobs in government agencies are, for the most part, filled on the basis of competitive examinations. Candidates for such work may have to meet very rigid requirements, especially with respect to age, height, health, strength, and emotional stability. FBI agents are also required to be graduates of either law or accounting schools. Many personal service workers need specialized vocational training; some, such as barbers and beauty operators, must usually obtain a license in order to qualify for regular employment. Chefs and cooks in restaurants must have either specialized training or considerable experience. On the other hand, such workers as kitchen helpers, maids, charwomen, and janitors need little, if any, training.

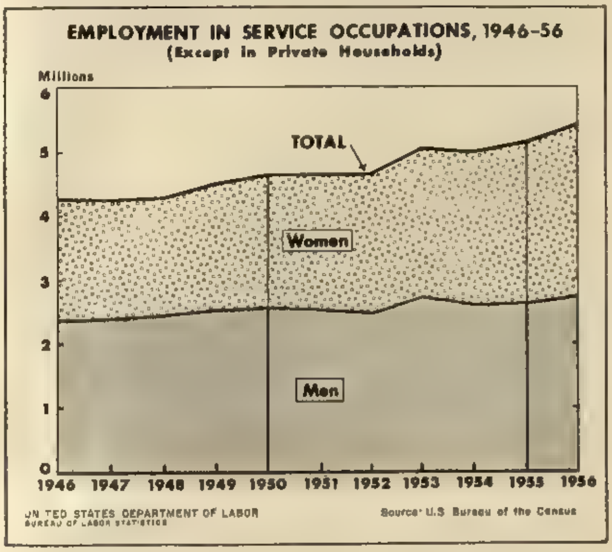
Employment Trends and Outlook

Private household workers, numbering 2 million in 1956, are the largest group in the service field. However, the proportion which domestic workers represent of all service workers is declining. In 1940, domestic service workers made up about 40 percent of all service workers, whereas in 1950, they comprised approximately 25 percent. The number of domestic workers fell sharply during World War II, as is likely to happen whenever there is an acute shortage of labor. Since the war, the number of private household workers has risen again but not as fast as service employment in general.

Employment in service occupations other than those in private households has risen sharply since 1940. Between 1940 and 1950, the number of service workers outside the home rose by more than

one-third—faster than the labor force as a whole. Employment of these workers has continued to rise more rapidly than the labor force, recording a gain of 18 percent between 1950 and 1956. (See chart 35.) The fastest growing service occupation for which Census data are available has been that of attendant in hospitals and other institutions—employment in this occupation more than doubled between 1940 and 1950.

CHART 35



During this period, employment rose 50 percent or more in the following service occupations: bartenders, cooks, charwomen and cleaners, practical nurses, and professional and personal service attendants not elsewhere classified. The number of waiters and waitresses, including counter and fountain workers, increased 40 percent. Only two large service occupations declined in size between 1940 and 1950—the number of boarding- and lodging-house keepers declined 60 percent and employment of barbers and beauticians dropped 8 percent. A substantial majority of the workers who entered service occupations during the 1940's were women; between 1940 and 1950, the proportion of women in service occupations, except private household work, rose from 38 to 45 percent.

Employment of service workers reflects the changing patterns of American living. Among the major reasons for the rise in service occupation employment, particularly outside private households, has been the urbanization of the population; the remarkable increase in the number of people employed in manufacturing and other nonagricultural industries; and rising income levels. Between 1940 and 1955, nonfarm employment rose more than 50 percent—about twice as fast as the population. Much of this increase was accounted for by a substantial rise in the number and proportion of working women in the labor force. These factors have greatly increased the need for services such as meal preparation and the care of the sick which, in former years, were provided to a much greater extent in the home. Between 1940 and 1950, half the rise in the total number of service workers outside private households was accounted for by greater employment in eating and drinking places and in hospitals and other health institutions. During this period, there was also an extremely sharp rise in the number of service workers in educational institutions, mainly to care for the many large, new consolidated schools and to provide meals for the many children who no longer brought lunches with them or went home at midday as was formerly the custom.

The growth of cities has also helped to create a greater demand for protective service workers. The number of such workers—firemen, policemen, and detectives—rose more than 30 percent during the 1940's, somewhat faster than the labor force as a whole, though much more slowly than many other service occupations.

In the long run, employment in service occupations will probably continue to rise substantially. As in the recent past, most of this growth is expected outside private households. Nevertheless, some rise in employment of domestic workers is likely, in view of the increasing number and size of families and the rising number of working mothers with young children. However, most job openings for workers in all service occupations, both in and outside private households, will result from the need to replace the thousands of workers who annually leave their jobs. Turnover is high in these occupations for several reasons—the high proportion of women, especially in private household work; the many temporary and part-time jobs; and the relatively low rates of pay in unskilled and semiskilled occupations. These factors will no doubt continue to operate creating many thousands of job openings each year.

Additional information on service workers in several fields of employment is given in the chapters on the Hotel and Restaurant industries and the statements on barbers, beauty operators, and practical nurses. (See index.)

Barbers

(D. O. T. 2-32.01)

Nature of Work

Barbers spend most of their time cutting hair. They also provide customers with other personal services such as shaves, facial and scalp massages, shampoos, and hair singes. In addition, they sometimes sell hair tonics, shampoos, and related preparations, and give advice on care of the hair and scalp. Barbers must know the latest hair styles and be alert to follow customers' instructions on the type of haircut they prefer. They must also try to finish each haircut in the way best suited to the shape of the customer's head.

A barber builds up a steady trade not only by giving good haircuts but also by putting customers at ease, giving them quick and courteous service, and keeping a clean, attractive shop. In small shops, a barber may keep his own work area clean or take his turn sweeping the shop. Each barber is usually responsible for keeping his barbering tools sterilized and sharpened. Barbers who run their own shops have responsibilities common to many small businesses, such as ordering supplies, paying bills, and hiring and managing employees.

Where Employed

More than 195,000 barbers were working in approximately 100,000 barbershops in 1950. A few thousand were employed in beauty shops and combined barber and beauty shops. The typical barbershop is a small (1- or 2-man) establishment in which the shopowner himself does all or part of the work. However, shops employing several barbers are to be found in large hotels and office buildings in downtown areas of cities and in a growing number of suburban shopping centers.

All cities and towns and most villages have barbershops. However, barbers are concentrated in large cities and in the most populous States.

Training and Other Qualifications

A license is required for both apprentice and master barbers in all States except Virginia. To obtain a license as an apprentice, the prospective barber must, in nearly all States, be a graduate of a State-approved barber school, pass a written examination, and demonstrate his ability to perform barber services in a practical examination given by the State board of barber examiners. In addition, most States require entrants to be at least 16 or 18 years of age, to have completed the 8th grade, and to meet certain health requirements. After receiving a license, the trainee must work as an apprentice in a barbershop for a specified period (18 months in most States). After completing this apprenticeship and, in most States, passing a second set of written and practical examinations, the trainee may be licensed as a journeyman (experienced) barber. Barbers who move to another State must usually take licensing examinations given by that State.

More than 100 public vocational schools and private barber colleges offer barber training. Courses are usually 6 or 9 months in length and include 1,000 or more hours of training. The prospective barber mainly studies basic barber services—haircutting, shaving, massaging, and facial and scalp treatments—and, under supervision, practices these services on people. In addition to attending lectures on barber services and the use and care of barber tools, students take courses in anatomy, sanitation, and hygiene, including the recognition of skin diseases. Instruction is also offered in salesmanship and general business methods.

Apprentice barbers may obtain their first jobs through employment services operated by the barber school they attended, through the barber's union, or through personal contacts in their local communities. Experienced barbers may advance by opening their own shops, by becoming managers of large shops, or by moving to shops which have more customers. Those who open their own shops must, of course, have the necessary capital to buy or rent quarters and equipment. The usual cost of equipping a 1-chair barbershop is roughly estimated at $1,500. However, costs differ greatly, since barbers can sometimes buy used equipment and fixtures at low prices or may decide to pay above average prices in order to get the best equipment. Each barber usually buys his own scissors and other tools while in barber school, at a cost of about $50 to $65.

Employment Outlook

Several thousand openings for barbers are expected each year during the late 1950's. Most openings will arise from the need to replace barbers who retire, die, or transfer to other fields of work. The death and retirement rate among barbers is high since they are an older group than workers in many other occupations; in 1950, half of all barbers were over 48 years of age and about a fifth were 60 or older. In addition, some experienced barbers, as well as many apprentices, have been attracted to other types of jobs—which have been relatively easy to obtain under the favorable economic conditions prevailing in recent years. The need for replacements will probably continue to create many openings for apprentice barbers during the rest of the 1950 decade.

Total employment in barbershops has been declining over the past 20 years. Among the factors contributing to the decline in number of barbers employed are the extensive use of mechanical and electrical razors which enable men to shave themselves easily, the raising of training requirements for new entrants to barbering, and the fuller use of the time of the barbers who have remained in the trade. The decline in employment has become slower during recent years, but the number of young men in the occupation has decreased; the median (average) age of barbers rose from 44 years in 1940 to 48 years in 1950. The ease with which young men, as well as experienced barbers, can obtain other jobs may lead to a further drop in the number of barbers in the late 1950's provided that the level of overall employment remains high. Such a drop in numbers of barbers would result in steadier work and more business for barbers remaining in the field, since the growth in population is constantly tending to increase the total demand for haircutting services. On the other hand, if an economic downturn should occur, thousands of barbers at work in other occupations might reenter barbering. This would create keener competition for barber jobs and curtail opportunities for newcomers to enter the field.

Over the long run, the growth of population will undoubtedly bring about an upturn in the total number of barbers needed. The small (1- or 2-man) barbershop will probably remain the most common type of establishment; however, the continuing shift of population to suburban communities should result in more opportunities to open large shops in these areas and in a need for larger staffs in shops already established there.

Earnings and Working Conditions

Barbers earned, on the average, between $3,000 and $4,000 in 1956. However, some barbers in the most desirable locations earned more than $5,000. These figures include tips, which often are an important part of barbers' earnings. Barbers tend to increase their earnings as they acquire a personal following. Those who own shops or are managers of large shops have the highest earnings. Most barbers not in business for themselves are paid on a commission basis—usually 60 to 70 percent of the money they take in—or receive salaries plus commission. However, some are paid straight salaries. A barber's income depends in part on the location of the shop, since the income level and tipping customs of the community, the competition from other barbershops, and the prices which can be charged all affect earnings. Haircut prices, for example, range from less than $1 in some communities to $2 in others. Earnings, of course, depend also on the barber's skill and personality, which help build up a personal following.

Barbers often have a longer workweek than employees in many other occupations—usually 45 to 50 hours or more. Most shops are open 6 days a week, but nowadays more and more barbers are working only 5 or 5½ days.

General good health and stamina are important for barbers, since they must stand on their feet for long periods and, much of the time, work with both hands above shoulder level. Although barbers often are continuously occupied during peak periods, there is frequently slack time which they usually use to take care of their tools or attend to personal matters. One-week vacations are common; some employees receive 2-week vacations. Some union contracts provide insurance and medical benefits.

The principal union which organizes barbers—both employed barbers and barbershop owners—is the Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietors' International Union of America. Barbershop owners or managers may also belong to the Associated Master Barbers and Beauticians of America.

Where To Go for More Information

Information on State licensing requirements may be obtained from the State board of barber examiners at each State capital.

General information on the occupation of barbers may be obtained from:

Journeymen Barbers, Hairdressers, Cosmetologists, and Proprietors' International Union of America, 12th and Delaware Sts., Indianapolis 7, Ind.

National Educational Council,
Associated Master Barbers and Beauticians of America,
537 South Dearborn St., Chicago 5, Ill.

Beauty Operators*

(D. O. T. 2–32.11 through .31)

Nature of Work

The great majority of workers in beauty shops are all-round operators who provide their customers a variety of services, largely related to the care of the hair. They cut, style, shampoo, curl, bleach, dye, or tint the hair. In addition, they give facial and scalp treatments, remove superfluous hair, arch and tint eyebrows, and give manicures. In large shops, operators may specialize in one phase of the work, as, for example, hair styling, hair dyeing, permanent waving, manicuring, or electrology.

A beauty operator putting finishing touches on customer's hair.

Where Employed

Beauticians work in all parts of the country, in both large and small communities. The majority are employed in small establishments employing 1 to 3 beauty operators in addition to the owner-operator, or are self-employed. Some large shops may employ 25 or more all-round operators and a number of specialists.

According to a trade report, more than 110,000 commercial beauty shops were operating in 1955. In addition to operators who work in these shops, some operators are employed at Government bases in foreign countries, on cruise ships, and in hospitals and other institutions.

The proportion of men among beauty operators is relatively small; available reports from some local areas indicate a ratio of about 2 percent. The men are for the most part in management jobs or in specialized occupations, such as hair styling.

Training and Other Qualifications

A beauty operator is required to obtain a license from the State cosmetology board in all States except Delaware and Virginia. The license is granted upon payment of a small fee (usually $5 to $10), after the applicant successfully passes an examination in both theory and practice of cosmetology. In order to take the examination, the applicant must satisfy certain requirements including usually a minimum age of 16 to 18 years, a health certificate, and completion of a cosmetology course in an approved private beauty school or a public vocational school. In a few States, the boards require that a beauty-school graduate gain experience in a commercial beauty shop under a special arrangement as a "junior operator" before taking the examination.

Courses in the more than 900 private schools reported in 1955 usually consist of from 1,000 to 1,500 clock hours of combined classroom work and practice in beauty service. In the majority of these schools, students could complete the courses in from 6 to 9 months. Cosmetology programs in public vocational schools are usually given in

*Prepared by the Women's Bureau, U. S. Department of Labor.

connection with other high school courses leading to a vocational high school diploma. Thus, besides learning the skills of the occupation, students generally take academic subjects offered in the 4-year, high school curriculum.

Apprenticeship training in a beauty shop is accepted as qualifying the applicant for the examination by about half the State boards. The period of apprenticeship is usually longer than the term in a private school and requires, in addition to instruction on the job by an approved operator, certain study courses in subjects related to the work.

The first job may be one of assisting an experienced beautician. After 3 months to a year on the job, the beginning operator may become an all-round operator performing a variety of operations. Later, the operator may specialize in one particular type of work (for example, as hair stylist, hair dyer, facial or scalp specialist, or permanent waver) or become a manager in a large shop. Those with adequate capital may set up their own shops, working alone or employing other beauticians. A trained and experienced operator may also find work as a teacher in a beauty school, as a representative for a manufacturer of cosmetics or beauty-shop equipment, as an electrologist, or as an inspector for a State licensing board. For some of these specialized positions, additional training may be needed, since many State boards require teachers, shop managers, and electrologists to obtain special license. Furthermore, many States set higher age, education, and experience requirements for the teaching license.

To be a success, the beauty operator should be able to establish friendly relationships with people. Dexterity is necessary in handling the hair; and a sense of form and artistry in cutting and styling is important, as are ability and willingness to understand instructions and customers' wishes. In addition, the work requires a great deal of standing, except, of course, for persons who do manicuring only.

Employment Outlook

Expansion in employment is expected to continue in this occupation because of the demands of the growing population and the tendency for an increasing proportion of women to patronize beauty shops. Although the introduction of inexpensive home-permanent wave kits helped women meet the shortage of beauty services which existed during and after World War II, it did not prevent further growth of the beauty service industry. The State Board Cosmetology Guide reports that the number of beauty shops in the United States increased from 1950 to 1955 by almost 10,000.

In 1950, the decennial census reported 190,000 women employed in beauty occupations. This included beauticians, manicurists, and barbers, as well as managers and proprietors of beauty shops. The number of operator licenses reported by State cosmetology boards for 1955 for both men and women was more than 15,000 above 1950.

In addition to jobs created by expansion, tens of thousands of job opportunities will be created annually by turnover in the beauty service field. This is a type of work in which a large number of young women are employed (almost one-third were under 30 years of age in 1950) and in which the turnover is high, because many leave to marry, raise families, or take other jobs.

The expected outlook assumes a continuation of the present high level of economic conditions. Changes in economic conditions are apt to have a marked effect on beauty-shop employment. Although women usually attach great importance to beauty services, they are likely to cut this expense if their income is reduced.

There are reasonably good opportunities for employment in this field for mature and older persons. In 1950, about one-fifth of the employed beauticians were 45 years of age or older. Opportunity for part-time work is another important feature of beauty-shop employment.

Some opportunities also exist for handicapped persons. Manicuring can be done by persons unable to stand for long periods of time; and there are instances of blind persons who are experts in massage treatments and deaf persons who specialize in electrology.

Earnings and Working Conditions

The majority of beauty operators, working in a shop for an employer, are paid a basic wage plus a commission. "Half of take beyond double," the usual formula, means that twice the operator's basic wage is subtracted from total fees paid by

the operator's customers, and one-half of the balance is paid to the operator as commission. However, some operators may be paid only a salary or only a commission. Information from scattered sources indicates that, in 1955, a beginning beautician was paid a basic wage ranging up to $50 a week, depending upon the type and location of shop. (A number of States have minimum-wage rates applicable to beauty operators.) By building up the number of customers, the earnings of the beautician can be increased substantially. Highly experienced operators may earn from $75 to $100 a week, and stylists and specialists in exclusive shops as much as $150 or more a week, not including tips. Tips paid directly to the operator also increase earnings. In some shops, where cosmetics are sold directly to customers, a small commission (up to 10 percent) may be paid to the beautician who sells these products.

Incomes of shop owners vary widely, from those of the beautician with a small shop who works only part time to those of the owner of an exclusive beauty salon in a large city.

Most employed beauticians work from 40 to 48 hours a week, although shop owners frequently work longer hours. Hours may be irregular, however, frequently including evening and Saturday work. Some States have overtime-pay provisions for hours beyond a specified minimum.

Beauticians employed in establishments such as department stores usually participate in the employee-benefit plans of the organization, including sick and vacation leave and pensions. Some shops allow their employees at least a week of vacation with pay.

Two unions for beauticians are active in the United States: the Journeymen Barbers, Hairdressers, Cosmetologists and Proprietors' International Union of America and the Barbers and Beauty Culturists Union of America, both affiliated with the AFL-CIO.

Where To Go for More Information

State boards of cosmetology can supply information on licensing and other requirements. Local vocational schools and private beauty schools can provide information on how the student can meet these requirements. A list of federally aided vocational schools that offer beauty courses is published by the U. S. Department of Health, Education, and Welfare, Office of Education, Washington 25, D. C. The following publication includes detailed information about the beauty service field:

Employment Opportunities for Women in Beauty Service. Women's Bureau Bull. 260, 1956. Superintendent of Documents, Washington 25, D. C. Price 25 cents.

Practical Nurses and Auxiliary Nursing Workers*

(D. O. T. Practical Nurse, 2-38.20; Nurse Aide, 2-42.20; Orderly, 2-42.10)

Nature of Work

Practical nurses and auxiliary nursing workers, who perform specified nursing duties for the physically or mentally ill and help maintain a comfortable environment for them, have become increasingly important members of the medical team over the past decade.

Practical nurses, also known as licensed vocational nurses or licensed nursing attendants, are primarily concerned with providing care and treatment to patients, under the supervision of physicians or professional nurses. As members of nursing teams in hospitals and health agencies, practical nurses perform many of the duties formerly carried by professional nurses, thus freeing professional nurses for those aspects of patient care and treatment requiring more extensive formal training and specialization of skills than practical nurses have acquired. Duties of a practical nurse include observing and recording symptoms and reactions of patients; giving prescribed treatments and medications, and carrying out personal hygiene measures for the patient. Other duties, such as making beds, serving meals, or caring for hospital equipment, may also be performed by practical nurses, although in many hospitals these tasks are assigned to persons of lesser training, such as nursing aides, attendants, or ward maids.

In private homes, practical nurses carry out the instructions of the attending physician or public health nurse, and they must exercise considerable judgment in recognizing nursing situations which are beyond their training and skill. Besides car-

*Prepared by the Women's Bureau, U. S. Department of Labor.

ing for the patient, practical nurses may be responsible for certain housekeeping duties in the home which are necessary to the patient's health and well-being. Practical nurses in doctors' offices assist physicians or professional nurses in the examination of patients, give simple medications or treatments, carry out routine laboratory tests, and perform some clerical duties. In industrial establishments, the duties of practical nurses may vary from providing first aid and emergency care to employees at the place of business to home-visiting services.

Auxiliary nursing workers, such as nursing aides, hospital attendants, ward maids, and orderlies differ from practical nurses in that their training is acquired on the job, and the more responsible duties of practical nurses are not assigned to them. Auxiliary workers are also regarded as members of nursing teams, sharing patient care to a limited extent, working under the supervision of professional or practical nurses. Auxiliary workers may be assigned such duties as feeding or bathing patients, keeping patients' rooms in order, changing linens, answering calls, and performing other tasks to assure the patients' comfort. In private households, auxiliary nursing workers may be known as mother's helpers or visiting housekeepers.

Where Employed

By far the largest number of practical nurses and auxiliary nursing workers are employed in hospitals and nursing homes. According to a 1955 survey of the American Hospital Association, hospitals employed some 400,000, of whom 16 percent were practical nurses; 36 percent, hospital attendants; 34 percent, nursing aides; 7 percent, ward maids; and 6 percent, orderlies. Small numbers of practical nurses and even smaller numbers of auxiliary nursing workers are employed in public health agencies, industrial establishments, and doctors' offices.

Practical nurses take positions in private homes also. In 1950, according to the decennial census, there were some 70,000 private duty practical nurses. It is unlikely that a significant increase has occurred in this total, since the more recently trained practical nurses tend to find work in hospitals or other health agencies.

Although nursing traditionally has been regarded as a woman's occupation, large numbers of men work in nursing services as orderlies, hospital attendants, and psychiatric aides. Some men are also employed as practical nurses, as well as professional nurses.

Training and Other Qualifications

Before 1945, the majority of practical nurses were either self-trained or learned their skills through practice on the job. During the past decade, however, training requirements have become increasingly formalized, licensing procedures have been instituted by most States, and standards of performance on the job have been established. Today, most practical nurses receive formal training.

Practical nurse training may be obtained in schools approved by State boards of nursing in States which provide for licensing of practical nurses, or by State boards of vocational education, or by the National Association for Practical Nurse Education (NAPNE) which offers a school accrediting service. Some schools have the approval of more than one of these organizations.

Approved schools are of two types: those operated by public-school systems, usually as a part of a State or local vocational school or adult education program; and private schools controlled by hospitals, health agencies, educational institutions, or community organizations. The past two decades have seen a tremendous growth in the number of training facilities. In 1930, there were 11 approved schools. In 1956, there were 412 schools which admitted 15,500 new students.

The usual period of training for practical nursing is 1 year, although there are variations among States, with courses ranging from approximately 9 to 18 months. About one-third of the course time in approved programs is spent in classroom work, and two-thirds is devoted to clinical experience in hospitals. A few extension and refresher courses are also available for practical nurses who wish to obtain additional training or who are preparing to qualify for licenses.

Tuition for practical nurse training runs up to approximately $250, but in some programs there is no charge for tuition. Vocational education programs under public-school systems may charge tuition for nonresidents only. There are, however, incidental expenses for books, equipment, or uniforms in all these programs. Tuition

scholarships, stipends, and allowances for room and board are available in a number of schools.

To be accepted by approved training schools, candidates usually must be between 18 and 50 years of age, although occasionally persons as young as 17 years or between 55 and 60 years are admitted. Applicants over 25 years of age usually must be at least eighth grade graduates, and applicants under 25 years must have completed 2 years of high school. Limitations on admitting married and older women to training programs seldom apply in practical nursing. Of the 1954 graduates from public school programs, two-thirds were or had been married; the average age of all 1954 graduates was 35 years.

Applicants are generally required to take an aptitude test and to submit letters of personal reference. Personal interviews, evaluation of school records, and other selection devices are commonly used in practical nursing today.

The licensing of practical nurses is a comparatively recent development, most of the legislation having been enacted since 1945. By 1955, however, all States except Colorado and West Virginia and the District of Columbia provided for the licensing of practical nurses. In most States, a license can be obtained by completing an approved training program and passing a State examination; by State endorsement of a license issued by another State having equal standards; or by a waiver issued for a limited time to experienced, but not formally trained, women in States that have recently passed licensure laws.

Auxiliary nursing workers usually receive their training in the hospitals and clinics in which they are employed. Training on the job varies among institutions, from a week to 3 months. Professional nurses may give classroom instructions and demonstrate techniques, and trainees may perform specified practice work. In other cases, training may be informal and consist of daily instructions for work assignments given by supervisors.

There are few specified educational or experience requirements necessary for auxiliary nursing worker trainees. Unlike practical nurses, they are not licensed workers. They usually can qualify for jobs if they are at least 17 years of age and are physically able to perform the tasks required. However, an eighth grade education is often required.

Employment Outlook

A substantial shortage of both auxiliary nursing workers and licensed practical nurses, particularly of the latter, was evident in 1956. As a result, there were practically no barriers of age, sex, marital status, race, or religion to the employment of persons in good health who were educationally qualified for these occupations.

Over the past 15 years, there has been a sharp upward trend in the number of practical nurses who have received formal training and who have been employed in hospitals. For example, between 1953 and 1954 the number of professional nurses in hospitals increased by 3.2 percent, but the number of practical nurses increased by 12.6 percent. Nevertheless, a shortage has existed because of expanding health services for an increasing population and a rising demand for practical nurses to perform some of the duties formerly assigned to professional nurses.

The demand for practical nurses and auxiliary nursing workers is expected to continue strong for the remainder of the 1950's and well into the 1960's. The success of using practical nurses and auxiliary nursing workers as members of nursing teams, working under the supervision of professional nurses or physicians, indicates that there will be an expanded use of these workers in most hospitals and health agencies. In particular, psychiatric aides, who have been trained to work with disturbed patients in mental institutions, will be in great demand. All types of nursing workers who have received training for their jobs will have good employment opportunities throughout this period.

Earnings

Average salaries of women employed as practical nurses in hospitals ranged from $38 to $63 a week, according to a survey made by the Bureau of Labor Statistics during 1956 and 1957 in 14 metropolitan areas. Male practical nurses averaged from $50.50 to $67.50 a week. Women nursing aides, whose duties were more routine than those of practical nurses, had average weekly salaries ranging from $29 to $59. Male nursing aides, who are usually called orderlies, had average salaries ranging from $36.50 to $62.50 a week. The following tabulation shows average weekly

salaries for men and women practical nurses and nursing aides in each of the survey areas:

City	Nursing aides		Practical nurses	
	Women	Men	Women	Men
Atlanta	\$29.00	\$38.50	\$43.00	------
Baltimore	38.00	43.50	47.00	\$65.00
Boston	44.50	50.50	51.50	61.00
Buffalo	44.50	59.00	49.00	52.00
Chicago	47.00	58.50	54.00	58.00
Cincinnati	42.00	51.50	52.50	58.50
Cleveland	40.50	48.00	51.50	------
Dallas	29.50	36.50	40.00	------
Los Angeles–Long Beach	52.50	56.00	59.50	66.00
Memphis	30.50	------	41.00	------
Philadelphia	35.00	43.00	38.00	50.50
Portland (Oreg.)	47.50	55.50	53.00	63.50
San Francisco–Oakland	59.00	62.50	63.00	67.50
St. Louis	36.50	47.00	44.50	58.50

A regular 40-hour workweek was reported for the majority of practical nurses and nursing aides covered by the salary survey of hospital personnel. For a few, however, the workweek ranged as high as 48 hours. The large number of practical nurses not employed by hospitals—particularly those on private duty—had varying lengths of workweek, depending on the type of employer.

Graduates of approved practical nursing schools or persons who have had equivalent training in hospitals, upon passing a written examination for civil service, were hired by the Federal Government at \$3,175 per year in 1956. Auxiliary nursing workers without prior training or experience, who qualified for employment by passing an aptitude test, were hired at \$2,960.

Where To Go for More Information

Additional details about practical nurses and auxiliary nursing workers are given in a U. S. Department of Labor's Women's Bureau publication. The Outlook for Women as Practical Nurses and Auxiliary Workers on the Nursing Team, Bulletin No. 203–5. 66 pp. Washington, D. C., 1953. Price 40 cents.

Information about these occupations may also be obtained from:

National League for Nursing, Committee on Careers, 2 Park Ave., New York 16, N. Y.

National Association for Practical Nurse Education, 654 Madison Ave., New York 21, N. Y.

National Federation of Licensed Practical Nurses, Inc.,
250 West 57th St., New York 19, N. Y.

Skilled Trades and Other Industrial Occupations

The trades and other industrial occupations—skilled, semiskilled, and unskilled—together provided jobs for nearly 4 out of 10 employed workers in the United States in 1956. The men and women in these jobs perform key functions in the economy. They help transform the ideas of the scientists and the plans of the engineers into goods and services. They help operate transportation systems, communication facilities, and atomic installations. They build homes, office buildings, and factories. Many work in factories where they build, install, control, maintain, and repair the tremendous amout of machinery needed by a complex industrial society. Others repair automobiles, television sets, and washing machines. The efficient operation of the Armed Forces also depends on skilled workers in uniform as well as upon civilian craftsmen to produce weapons, vehicles, ships, tanks, planes, and communications equipment.

To young people who have mechanical or manual interests and abilities, the trades and other industrial occupations offer the bulk of employment opportunities. Within this area, there is a wide range of occupations varying in skill and earnings from the unskilled laborer to the highly skilled tool and die maker.

Although the jobs in the trades and industrial occupational groups can be classified into three categories—skilled, semiskilled, or unskilled—there is no clear-cut dividing line between the skill levels and, therefore, skill classifications must always be somewhat arbitrary. This is so because the nature of the work performed in these jobs often changes as new machines or methods are introduced. Thus, some of the types of work formerly done by skilled craftsmen have been broken down into several simpler jobs, each requiring a much shorter period of training than was originally demanded of the craftsmen. These simpler jobs can be performed by workers who are usually classified in the semiskilled category but, in some cases, they still retain the title of a skilled worker.

Similarly, job titles sometimes fail to reflect levels of skills. For example, the job title "carpenter" may designate workers at various skill levels, ranging from those who are able to work from blueprints in fashioning a complicated structure to those who have little more skill than handymen, using only a saw and hammer. Also, workers classified as "operatives" by the Census Bureau are generally considered to be semiskilled, but some might be considered skilled based on their training, functions, and earnings.

During the past two centuries, the occupational structure of our economy has undergone a major but gradual transformation as a result of the widespread introduction of machinery and mass-production techniques. The emergence of the factory system of production, which emphasized the division of labor and specialization of function, changed our economy and resulted in the appearance of many new skills and trades. New occupations arose and others were drastically altered. The manufacturing industries, with their greater potential for division of labor, were particularly influential in these occupational changes. The groupings of kinds of labor into such categories as skilled, semiskilled, and unskilled was primarily a result of factory production.

Trends in the last half century suggest that the principal effect of the steady advance of technology, in the factories and on the building site, has been to reduce dramatically the proportion of unskilled workers in the work force. At the same time, the proportion of semiskilled workers in our labor force has increased significantly and the percentage of skilled workers has remained relatively stable.

Today, many people believe we are on the threshold of a new age of industrial progress which may affect the future occupational structure of the labor force. Rapid increases in the industrial application of scientific knowledge and invention, particularly in the field of electronic controls and computers, are making possible the increasing "automation" of work processes. Automation is a term which has been used increasingly in the past few years to describe this most recent phase of America's industrial development. Although automation has been defined in many ways, it is generally agreed that, in our factories, it involves the

use of electronic, mechanical, hydraulic, pneumatic, or other devices to feed, control, handle, and adjust the machinery and equipment used in a production process.

Automatic technology to date has had limited application in industry generally and, therefore, it is still too early to know the full impact it may have on employment and occupational skills. Employment in skilled and semiskilled groups is expected to continue to increase during the next decade despite the anticipated increasing use of automation. It appears that the increasing application of automation during the next decade will cause moderate changes in skill requirements among the trades and other industrial occupations. Except for the semiskilled group, these changes will broadly represent extensions of past trends in occupational employment that have resulted from advancing technology. A moderate increase in the relative importance of skilled workers is anticipated. The increasing amount of complex and costly automatic machinery will require more highly skilled craftsmen to make, install, operate, and maintain this machinery. The long-term decline in the relative importance of the unskilled is expected to continue as machine power is increasingly substituted for these workers. The semiskilled group, as a proportion of the work force, will be relatively stable. Semiskilled workers have been one of the fastest growing occupational groups, but as simple, repetitive operations such as the feeding or manipulation of a machine are taken over by automatic devices, the growth of this group will be slowed.

The reports on the trades and other industrial occupations which follow are grouped by industry or field of work, rather than by level of skill, since this is the most useful grouping for practical vocational guidance. The occupations which are found in a wide variety of industries, or in industries for which an entire chapter has not been prepared, are included in this section of the Handbook. The great majority of the trades and other industrial occupations, however, are described in the section, Some Major Industries and Their Occupations.

Skilled Workers

Our Nation's economic and military strength depends to a great extent on the initiative, competence, and skills of its craftsmen. The contributions of our physicists, engineers, chemists, and other professional workers to our national security and well-being are transformed into goods and services by a skilled, intelligent, and flexible work force.

Skilled workers make the patterns, models, tools, dies, jigs, machines, and equipment without which industrial processes could not be carried out by semiskilled and unskilled workers. Skilled craftsmen repair the equipment used in industry as well as the mechanical equipment and appliances used by consumers. They also construct our homes, buildings, and highways.

Skilled workers require a thorough and comprehensive knowledge of the processes involved in their work. They exercise considerable independent judgment and often have a high degree of manual dexterity. In some instances, they are responsible for valuable equipment or products. Workers in skilled occupations usually require an extensive period of training.

Young people should consider seriously the greater advantages which the skilled trades offer compared with semiskilled or unskilled jobs. With training and experience in a craft, a man often has a wider choice of jobs. It is possible to shift to other jobs within an industry as well as to jobs in other industries. Such a worker is able to handle not only the skilled job in the plant but also, if necessary, one requiring less skill, and he is, therefore, more valuable to his employer than the person who can operate only one machine. In many plants, the skilled worker, who understands the whole process, is given preference in promotion to a foreman's job. Knowledge of a craft pays off in job security and usually in earnings as well. Skilled workers appeared to have steadier employment according to the 1950 Census, which showed that a larger percentage of these workers were employed 50 or more weeks in 1949 compared with either semiskilled or unskilled workers. Also, their average income in that year was nearly 20 percent higher than that of semiskilled workers and almost 60 percent more than that of unskilled laborers. The skilled occupations also provide opportunities for self-employment. The prospect of becoming an independent contractor, for example, is an important incentive for some people to enter the skilled building trades. Many other craftsmen open up their own small repair shops.

The key functions performed by craftsmen suggest why employment in the skilled occupations has grown from about 5 million skilled workers and foremen in 1940, or about 1 out of 9 of our civilian working population, to about 8.7 million, or about 1 out of 7, in 1956. Continued growth in the number of skilled jobs is expected in the next decade. Many other job opportunities for young persons to become craftsmen each year will result from the need to replace skilled workers who die, retire, or transfer to other fields of work.

Changing technology and economic conditions will affect job opportunities for skilled workers in many occupations and industries. As mechanical equipment becomes more widely used, the large and growing mechanics and repairmen group of occupations should provide many thousands of job opportunities for auto mechanics, industrial machinery repairmen, maintenance electricians, diesel mechanics, business machine repairmen, and refrigeration and air-conditioning mechanics and repairmen. In the building trades, substantial numbers of job openings for skilled workers are expected to occur as a result of the anticipated sharp rise in the level of construction activity. The major skilled machining occupations—tool and die maker, machinist, machine tool operator, set-up man, and layout man—should provide large numbers of job openings in many industries. Employment of skilled craftsmen in petroleum refining and in the chemical industry—particularly instrument repairmen, pipefitters, electricians, and maintenance mechanics—is expected to grow at a faster rate than total employment in these highly automated industries. In the skilled printing trades, moderate growth of employment is anticipated. Employment of skilled workers in the automobile and aircraft industries is expected to increase numerically and percentagewise as a result of these industries' increasing dependence on automatic operations; job opportunities will be particularly favorable for maintenance workers such as millwrights, industrial machinery repairmen, and pipefitters.

Skilled workers are employed in almost every industry, but the largest numbers are employed in manufacturing and construction. About 40 percent of the craftsmen were in the manufacturing industries and 25 percent in the construction industry, according to the 1950 Census of Population. Of all employed craftsmen, 84 percent were wage or salary workers for private employers, about 10 percent were self-employed, and about 6 percent were government workers. The building trades generally had a fairly large percentage of self-employed. Other individual occupations with large proportions of self-employed included automobile mechanics and shoemakers. As might be expected, employment of the skilled work force was concentrated in the more highly industralized States. Five States with more than half a million craftsmen each—New York, Pennsylvania, California, Illinois, and Ohio—accounted for about 2 out of every 5 skilled workers. Job opportunities for skilled workers, however, are found in every State.

More than half of the country's skilled workers in 1950 were employed in 3 skilled occupational groupings—building trades, mechanics and repairmen, and machining occupations. The Census also reported that more than half a million workers were employed in each of 3 skilled occupations—carpenters, automobile mechanics and repairmen, and machinists; in addition, there were more than 800,000 foremen. (See table.) There were 15 skilled occupations with more than 100,000 workers each. Most skilled occupations, however, had relatively small numbers of workers.

Employment in selected skilled occupations, 1950

Occupation	Number of workers (in thousands)	Percent
Total craftsmen, foremen, and kindred workers	7,700.7	100.0
Mechanics and repairmen	1,690.9	22.0
Automobile	642.8	8.4
Radio and television	73.9	1.0
Airplane	70.6	.9
Railroad and car shop	48.0	.6
Office machine	17.0	.2
Not elsewhere classified	838.6	10.9
Carpenters	902.4	11.7
Foremen (not elsewhere classified)	840.7	10.9
Machinists	503.5	6.5
Painters, construction and maintenance	389.6	5.1
Electricians	304.3	4.0
Plumbers and pipefitters	273.9	3.6
Stationary engineers	214.3	2.8
Linemen and servicemen, telegraph, telephone, and power	210.3	2.7
Compositors and typesetters	172.6	2.2
Brickmasons, stonemasons, and tile setters	164.4	2.1

Employment in selected skilled occupations, 1950—Con.

Occupation	Number of workers (in thousands)	Percent
Toolmakers, diemakers, and setters	153.9	2.0
Tinsmiths, coppersmiths, and sheetmetal workers	118.7	1.5
Bakers	115.4	1.5
Excavating, grading, and road machine operators	105.1	1.4
Cranemen, derrickmen, and hoistmen	103.0	1.3
Inspectors (not elsewhere classified)	93.4	1.2
Tailors and tailoresses	80.4	1.0
Cabinetmakers	72.1	.9
Locomotive engineers	71.2	.9
Millwrights	59.3	.8
All other craftsmen, foremen, and kindred workers	1,061.3	13.9

SOURCE: U. S. Bureau of the Census.

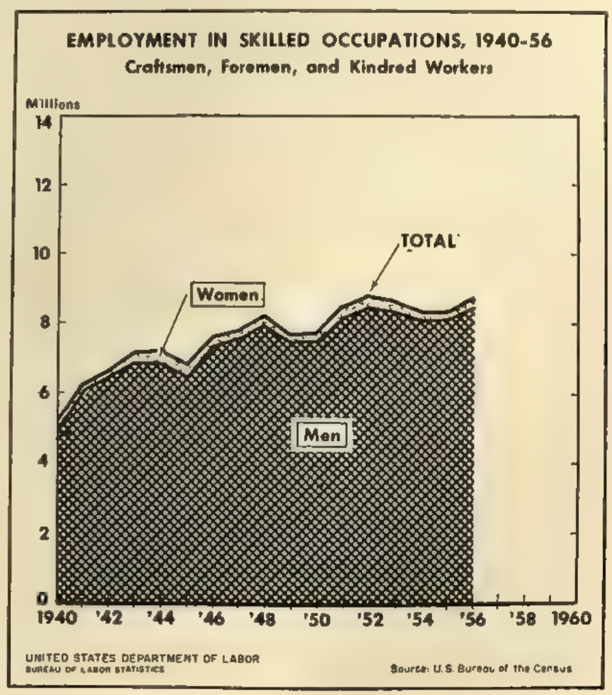
The relative importance of occupations within the skilled group has been changing. Those occupations which are concerned with the repair and servicing of machinery and equipment have shown the greatest proportionate growth in recent years. This has been largely the result of the increasing mechanization of our industrial and business processes and the greater use of electrical and mechanical appliances in our homes. Between 1940 and 1950, the mechanics and repairmen group of skilled occupations about doubled. Large relative gains were also made in the building trades—particularly for cement and concrete finishers, carpenters, plumbers and pipefitters, and electricians. However, in some skilled occupations employment declined over the decade; among these were tailors, blacksmiths, metal molders, and paperhangers.

Skilled labor requirements have fluctuated with the needs of the economy and national defense. During the depression of the 1930's, the demand for skilled workers was severely reduced. Training of young persons had virtually stopped and restrictions on immigration adopted in the 1920's had curtailed a major source of skilled labor. During World War II, the need for rapid and substantial expansion of the skilled labor supply was partially met by recruiting skilled workers from among the unemployed and those engaged in less skilled occupations. Also, the number of hours worked was increased and semiskilled and other workers who had brief training or some qualifying experience were temporarily up-graded to craft or foreman jobs. Skilled jobs were broken down so that they could be performed by less skilled workers. The skilled labor supply was also increased by intensive training programs.

In the immediate post-World War II period, employment of skilled workers rose sharply with the expansion in construction activity and increased industrial activity needed to supply the pent-up demand for consumer products. (See chart 36.) Employment of these workers declined in late 1949 and early 1950, but rose sharply to meet the mobilization production requirements during the Korean hostilities. After some decline at the end of the Korean hostilities, the number of skilled workers continued its upward trend; by the end of 1956, about 8.7 million craftsmen, foremen, and kindred workers were employed.

Employment of skilled workers is expected to exceed 10 million by 1966 as a result of such factors as the trend in the growth of the population and labor force, prospective growth in industry, and the changing occupational patterns within industry. There will be differences in the rate of employment growth in the various skilled occupations in the next decade. For example, as mechanical equipment becomes more widely used the mechanics and repairmen group of occupations should grow at a faster rate than the skilled labor force generally. Similarly, the building trades

CHART 36



should show a rapid growth as a result of the anticipated sharp rise in the level of construction activity. On the other hand, the skilled printing trades, one of the larger groups of skilled workers, will increase at a slower rate than the average of the skilled work force.

Skilled workers are developed in the United States in several different ways. Some workers acquire their skills through apprenticeship or other formal training programs; others qualify by picking up the skills of their trades through experience on the job, or by working with skilled craftsmen. Some young persons also learn the skills or part of the skills of a trade in vocational schools.

Most training authorities agree that the best way to learn a trade is through a formal apprenticeship program. Apprenticeship is a period of on-the-job training, supplemented by related trade instruction, which is designed to acquaint the apprentice with the materials, tools, skills, and principles of the trade. The apprenticeship provides the worker with a balanced knowledge of his trade and the ability to perform required operations competently. The formal apprenticeship agreement stipulates the years of overall training and the number of hours of training the apprentice is to receive in the various aspects of the trade. Most apprenticeships run for periods varying from 2 to 4 years—but some last as long as 6.

Apprenticeship has a number of advantages over less formal methods of learning a trade. An apprentice receives broad training and experience which enables him to adjust more easily to changing job requirements. He is likely to be more versatile and able to work in a wider range of jobs. The completion of an apprenticeship gives the worker a recognized status which gives him an advantage in securing new jobs as well as greater job security. Many firms select their foremen from among their apprentice-trained workers because they are likely to be thoroughly familiar with all aspects of the work being performed.

Many companies have established training programs which are not apprenticeships but which provide workers with on-the-job training and, frequently, with supplementary classroom instruction. In these programs, new workers begin on the simplest tasks under the direction of a foreman or an experienced worker. They move to progressively more difficult work until they achieve the necessary skills.

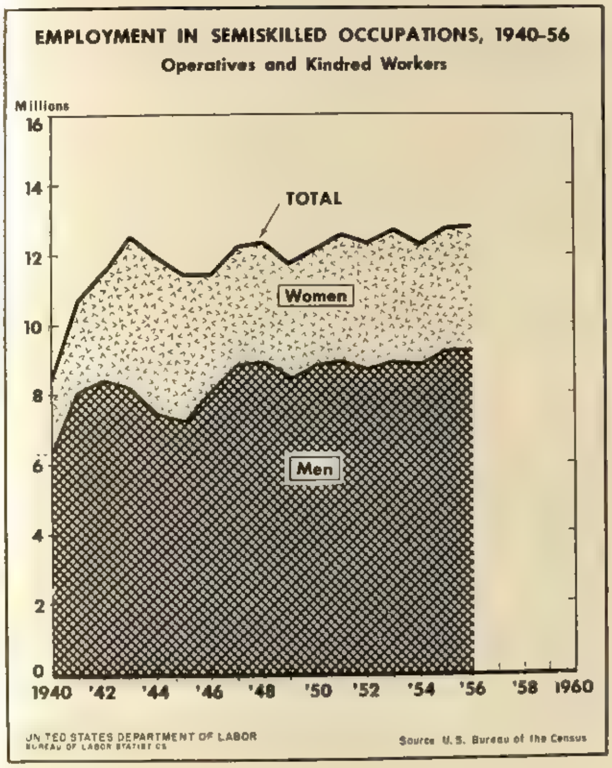
Many persons, in moving from one semiskilled job to another with different employers, pick up knowledge and skill which eventually enables them to become skilled workers. Many young people also learn the rudiments of a skilled trade by attending vocational, trade, or technical schools. A small proportion of these graduates are able to move directly into jobs in their trade and, after acquiring experience on the job, are able to qualify as skilled workers. In other cases, young persons who are already employed in semiskilled or unskilled jobs have been able to move into the skilled categories by taking vocational courses related to their work.

Many young men acquire skills in the armed services which enable them to qualify or shorten their training period for skilled jobs in civilian life. It is estimated that a fourth of the young men in the armed services are given extended school and on-the-job instruction which helps to prepare them for many skilled or technical occupations such as automobile mechanic, electronic technician, airplane mechanic, electrician, office machine repairman, and painter.

Semiskilled and Unskilled Workers

In 1956, nearly 13 million men and women—about one-fifth of the total workforce—were "operatives," the Census designation for those who are often called semiskilled workers. (See chart 37.) Like all broad occupational classifications this one contains jobs varying widely in the nature of the work, in earnings, and in levels of skill. For example, truck driving, one of the largest occupations in the semiskilled group, may call for skill in driving, knowledge of routes and traffic rules, ability to make minor repairs, some clerical work, and independent responsibility and judgment. On the other hand, some machine operator jobs in industry require only the repetition of a half-dozen different motions all day long—reach for a metal blank and put it in the machine, pull the lever, press the button, take out the piece of metal, which now has been stamped or cut, and place it on a pile, reach for another metal blank, etc. Such a routine can be picked up in a day and mastered in a few weeks. Many other semiskilled jobs require a number of months to learn.

CHART 37



With some exceptions, such as the truckdriver's occupation, semiskilled jobs generally are fairly routine and repetitive. Often they pay fairly well, particularly when a worker's pay is based on the amount of his production, under an incentive system. Unlike the skilled worker, the semiskilled worker does not need to invest many years of his life learning a trade, but frequently this is a disadvantage. Because of his limited training, he is less valuable to employers and thus may have lower earnings and less job security. However, the semiskilled worker can more easily adapt to new opportunities as they arise. Should the chances for employment disappear in one field of work, as often happens when some new process displaces an existing one, it is usually the semiskilled man who most readily writes off his investment of time and experience in that field, finds another job and, in a brief period of training, learns the new occupation.

Rather than intensive training in a vocational school in one type of work, a semiskilled worker should have some familiarity with different types of work—machine shop, woodworking, welding, electrical work, etc. He does not need to attain proficiency in any one of these fields, but does need a familiarity with the different types of processes and machines so that he can adapt readily to them.

Semiskilled workers have been one of the fastest growing occupational groups in the American labor force. For example, in 1930, they made up about 16 percent of the Nation's labor force, and by 1950, they had increased their proportion to about 23 percent. During the 1955–66 decade semiskilled workers will obtain a substantial share of the expected large increase in total employment. However, employment in this group, as a proportion of the total working population, is expected to be relatively stable.

The increased employment of semiskilled workers has been accompanied by a long-term downward trend in the relative importance of unskilled laborers in the work force. This trend is likely to continue as a result of further mechanization in materials handling and construction equipment. In 1956, about 3.5 million persons were employed as laborers in industry (excluding those on farms and in mines).

Unskilled laborers work in jobs which require no previous education or special training. The worker can learn the task he must perform in a very short time on the job. Unskilled jobs frequently involve manual handling and moving of heavy objects or materials. Such jobs are found mainly in manufacturing, construction, and transportation.

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THE BUILDING TRADES

The largest group of skilled workers in the American labor force are employed in the building trades. These craftsmen constitute a related group of workers primarily because they are all closely identified with the construction process. Altogether, there were about 2.8 million building trades craftsmen in mid-1956—about one-third of all the skilled workers in the United States. The more than two dozen skilled building trades vary greatly in size. The great majority of the skilled building craftsmen are employed in six major trades—carpenters, painters, plumbers and pipefitters, bricklayers, operating engineers, and construction electricians—each with over a hundred thousand workers. The 1.2 million carpenters alone accounted for about 40 percent of all skilled building trades workers. By contrast, only a few thousand workers were employed in each of several trades including marble setters, terrazzo workers, tile setters, glaziers, stonemasons, and elevator constructors.

There are several reasons why young men should consider one of the building trades as a career. They offer especially good opportunities for those who are not planning to go to college and who are willing to spend several years in learning a skilled occupation. Well-trained journeymen can find job opportunities in all parts of the country. Their hourly wage rates are generally much higher than those of most other manual workers and they may enjoy more economic independence. Journeymen with business ability have greater opportunities to establish their own business than workers in many other skilled occupations. Historically, employment in most building trades has expanded despite technological developments.

A principal disadvantage of work in the building trades is the sharp employment fluctuations that result from changes in general business conditions. In the past, declines in building trades employment have been much greater than those in most other industries. Another disadvantage is that even during years of high levels of construction activity, annual earnings of workers in the building trades are somewhat limited by the seasonal nature of construction work. Time is lost as a result of bad weather and other interruptions. In addition, construction jobs generally are of short duration and building craftsmen must spend time in finding their next job. Continually changing, and sometimes inconvenient, places of employment are also disadvantageous.

What Are the Building Trades?

Building trades craftsmen are skilled workers employed mainly in the construction, maintenance, repair, and alteration of homes and other types of buildings, highways, airports, and other structures. The wide range of materials and skills used in construction work has permitted specialization of various work operations; accordingly, building trades workers who use essentially the same materials or skills have tended to become identified with distinctive trades. For example, brickmasons and stonemasons work with masonry materials. Although operating engineers work with no particular materials, they have a group of related skills which enables them to handle various types of excavating, grading, hoisting, and other equipment.

The building trades consist primarily of journeymen (skilled workers) who generally must have a high level of skill and a sound knowledge of assembly and construction operations. They are often assisted in their work by tenders, apprentices, and laborers.

Journeymen may be grouped into three broad classifications—structural, finishing, and mechanical. However, some craftsmen—for example, carpenters—may do finishing as well as structural work. Generally, the building trades are classified in one of these three categories, as follows:

Structural—carpenters, bricklayers, stonemasons, cement or concrete masons, structural iron workers, ornamental iron workers, reinforcing iron workers (rodmen), riggers, boilermakers, and operating engineers.

Finishing—lathers, plasterers, marble setters, tile setters, terrazzo workers, painters, paperhangers, soft-floor layers, glaziers, roofers, and asbestos workers.

Mechanical—plumbers and pipefitters, millwrights, construction electricians, sheet metal workers, and elevator constructors.

All but a few of these skilled trades are described in detail individually, later in this chapter. These descriptions are necessarily brief and incomplete. They do not apply fully to all localities because of local differences in the scope of the various trades. Also, they are not statements or recommendations concerning the jurisdiction of these trades and are inappropriate for use in jurisdictional negotiations, or the settlement of jurisdictional disagreements.

Where Building Trades Workers Are Employed

Building trades workers are employed mainly in the contract construction industry; others work on "force-account" construction, are self-employed, or use their construction skills mainly in maintenance work in industries other than construction, particularly manufacturing.

The building craftsmen who work in the contract construction industry are employed by general and special-trade contractors. General contractors may be classified as building (residential, commercial, or industrial), highway, or heavy construction contractors since most of them limit their operations to one of these activities. They construct buildings and other structures (dams, bridges, roads, etc.), taking full responsibility for the complete job, except for any specified portions of the work that may be omitted from the general contract. Ordinarily, general contractors do most of the work with their own crews, but they often subcontract particular phases of the construction job to special-trade contractors.

Special-trade contractors usually do the work of only one trade (for example, painting or electrical work), or of two or more closely related trades (plumbing with or without heating, or plastering with or without lathing). Beyond fitting their work to that of other trades, they have no responsibility for the structure as a whole. The special-trade contractors obtain orders for their work from general contractors, architects, or from property owners. Repair work is almost always done on direct order from the owners, occupants, architects, or rental agents.

There are several hundred thousand contractors (both general and special-trade), most of them operating in local areas. The great bulk of them are fairly small—generally employing fewer than 10 workers. However, some firms are quite large—employing several thousand workers each.

Skilled building trades craftsmen are also employed by government agencies and business establishments which do not use the services of a contractor but do their own construction (force-account) or repair work.

Many building trades craftsmen are self-employed. Self-employed journeymen work directly for many property owners on small jobs. They may be paid by the hour or the day, or they may be paid an agreed price for the job, either providing the materials and including them in the price or using materials provided by the owner. Self-employment is most common in carpentry and painting, but is also found in most other skilled building trades.

In some of the trades, work may be performed away from the construction site. For example, sheet metal workers may be employed in shops where ducts are fabricated for installation in a building. Many building trades craftsmen are also employed to do maintenance work in factories, stores, mines, hotels, and almost every other type of large business establishment.

A skilled building craftsman's work is identified with a specific trade, such as carpentry or bricklaying, rather than with an individual contractor or even a broad group of contractors. Thus, a carpenter may be employed mainly by a particular builder but, in the course of a year, he may be employed by a concrete contractor to build forms for a concrete bridge; by an electrical or plumbing contractor to build a temporary structure at a large construction site; or he may contract to do a small repair job on his own.

Building trades craftsmen are employed in almost every community. These widespread opportunities are important for young persons interested in a career in the skilled building trades. Once they learn one of the trades they can find jobs not only in their own community but in almost any part of the country. Employment of these workers is distributed in much the same way as the Nation's population. Thus, employment is concentrated in the industralized and highly populated areas. Nine States—New York, California, Pennsylvania, Texas, Illinois, Ohio, Michigan, New Jersey, and Massachusetts—accounted for more than 50 percent of total employment in the skilled building trades.

Training, Other Qualifications, and Advancement

Apprentice training under a formal apprenticeship agreement registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training is considered by training authorities generally to be the best way to acquire the all-round proficiency of a skilled building trades worker. Apprenticeship is a prescribed period of on-the-job training supplemented by related trade instruction which is designed to develop skill and to make the apprentice familiar with the materials, tools, and principles of his trade. It provides him with a balanced knowledge of his field of work and enables him to perform its operations competently.

In addition to the apprenticeship method, many skilled craftsmen have learned their trades informally. Most of these workers have picked up a trade through several years of on-the-job experience. Generally, they first worked as laborers and helpers and learned the skills of a trade by working with and observing the work of experienced craftsmen. Some building craftsmen have acquired their skills, or part of their skills, by attending vocational or trades schools.

Generally, apprentices in the building trades are required to be between the ages of 17 and 25, and in good physical condition. A high school education or its equivalent, with course work in mathematics and the sciences, is desirable. Often, applicants are given tests to determine their aptitude for a particular occupation. For some skilled building trades, it is important to have considerable manual dexterity, mechanical aptitude, a discerning color sense, and an eye for quickly determining proper alinement of materials.

The formal apprenticeship agreement generally stipulates a training period of 3 to 5 years of relatively continuous employment and training, supplemented by at least 144 hours a year of related classroom instruction. The journeymen on the job and the foreman explain to the apprentice how the work is done and show him how different operations are performed and how different tools are used. Ordinarily, most of this instruction is given by a particular journeyman to whom the apprentice is assigned. The apprentice is required to do work of progressively increasing difficulty and with progressively less supervision.

Related classroom instruction varies among the trades, but usually includes courses such as: History of the trade; characteristics of the materials used; shop mathematics as related to the trade's work; rudiments of engineering where appropriate (particularly for pipework, ventilating systems, and electrical work); sketching, elementary drafting, and interpretation of drawings; safety practices; and special-trade theory such as color harmony for painters and elementary sanitation for plumbers. Such related instruction is seldom offered in small communities where there may be only a few apprentices and a small number of journeymen in a particular trade. In these areas, apprentices receive instruction through courses offered in the local high school or by itinerant instructors, generally furnished by the State. Other subject matter requirements are met through personal instruction by local journeymen and contractors or, in some cases, by correspondence courses.

The formal registered apprenticeship agreements also recommend the length of time the apprentice is required to work in each major operation of the trade as well as his rate of pay at successive levels of advancement. The apprentice is paid at an advancing rate, usually starting at 40 to 50 percent of the journeyman's pay. The apprentice's rate increases at 6-month intervals until a rate of about 90 percent of the journeyman's rate is reached in the final months of training. Often, advanced apprenticeship standing and pay are given to apprentices for trade skills acquired in the Armed Forces, or through trade school instruction. Advanced standing is granted on an individual basis and is usually determined by a demonstration of trade skill and knowledge.

In most communities, the apprenticeship programs are supervised by joint apprenticeship committees composed of representatives of the local employers or employer groups and the union local. In these cases, the apprentices sign their apprenticeship agreements with these committees. The committee determines the need for apprentices in the locality and establishes minimum apprenticeship standards of education, experience, and training. Where employers cannot provide the diversity of experience necessary to give an apprentice all-round instruction in the various branches of the trade, or relatively continuous employment over the entire period of apprenticeship, the committee transfers the apprentice to another employer. Where specialization by contractors is extensive—for instance, in electrical work—it is

customary for the joint committee to rotate apprentices among several contractors in the trade at intervals of about 6 months. In some large cities the local joint apprenticeship committee employs a coordinator to supervise the apprenticeship program.

In areas where these committees have not been established, the apprenticeship agreement is solely between the apprentice and an employer or employer group. Many journeymen have received worthwhile training under these types of apprenticeship programs, but these programs may involve some element of risk for the apprentice. In such instances, there is no joint committee to supervise the training offered, to settle differences over the terms and conditions of apprentice training, or to arrange a transfer in cases of personal incompatibility between the apprentice and the employer. The apprentice's training depends principally on his employer's business prospects and policies. If the employer lacks continuous work or does only a restricted type of work, he cannot provide the apprentice with the all-round training needed to develop journeyman skills.

In many localities craftsmen, most commonly construction electricians and plumbers, are required to have a journeyman's license to work at their trade. To qualify for these licenses, they must pass an examination showing a well-rounded knowledge of the job and of State and local regulations.

More detailed information concerning the training, other qualifications, and advancement of building trades workers is given later in this chapter in the discussion of the individual occupations in the building trades.

Advancement opportunities for building trades craftsmen are quite varied. For example, a journeymen may become a foreman in charge of his employer's crew. In most localities, small jobs are run by "working foremen" who work at the trade along with members of their own crews except when engaged in supervisory or management duties. On very large jobs, the foremen do no actual production work. A craftsman can also become an estimator for a contractor. In this job he estimates material requirements and labor costs in order to enable the contractor to bid on the work of a particular construction project. Some craftsmen advance to jobs as superintendents on large projects. Other craftsmen become instructors in trade and vocational schools.

In addition, many thousands of journeymen have become contractors. Sound journeyman knowledge is a great help in assuring success as a contractor. However, the successful contractor must also have the ability to plan work, to foresee needs and problems, to direct others, to estimate material and time requirements for jobs on which he is bidding, and a sound knowledge of business practices and financing.

Awards of contracts on the basis of competitive bidding, relatively moderate fixed capital requirements, liberal credit arrangements to facilitate the purchase of materials, and the possibility of conducting a fairly substantial business from the proprietor's home, all combine to make it easier to enter a small contracting business in the construction industry than it is to start a small business in many other industries. Because it is easy to enter the contracting business, competition is usually very keen, especially for smaller jobs. For larger jobs, considerable working capital and investment in equipment are necessary. Some States or municipalities require contractors to be licensed.

Employment Outlook

A continued upward trend in the employment of skilled building trades workers is expected during the late 1950's and the 1960's. The rate of employment increase for these craftsmen is expected to be greater than the rate of growth of the Nation's total labor force. In addition to openings resulting from an increase in employment, thousands of job opportunities for new workers to enter the building trades will result from the need to replace skilled workers who die, retire, or transfer to other fields of work.

The favorable employment prospects for these skilled workers will result primarily from the expected large rise in the level of construction activity, continuing the post-World War II trend. The postwar construction trend can best be illustrated by an examination of construction expenditures. Total construction expenditures (including maintenance and repair) rose from $20 billion in 1946 to about $60 billion in 1956 (actual expenditures not adjusted for changes in price levels). The rate of growth for new construction during the same period was even greater—from $12 billion to $44 billion. Expenditures for maintenance and repairs about doubled—increasing from about

$8 billion to nearly $16 billion. The post-World War II growth of the construction industry can also be seen in the increase in construction employment. For example, in contract construction, which employs a majority of the skilled building craftsmen, employment in the 1946–56 decade rose from 1.7 million to about 3 million, or about 80 percent.

The same factors which accounted for the rapid postwar expansion in construction activity are expected to result in a further growth in the construction industry during the 1956–66 decade. These include the high level of personal and corporate income, the rising volume of business activity, the growth in population and number of households, the size of governmental expenditures for highways, schools, etc., and defense expenditures.

During the 1946–56 decade, personal disposable income rose from $1,126 per capita to more than $1,700, the population increased by about 19 percent, and households by about 25 percent. Assuming a continued high level of business activity, personal disposable income is expected to increase significantly during the 1956–66 decade. Population and households are expected to increase by about a sixth during this period. Record highway construction expenditures are anticipated in the next 10 years under the Federal Government's multi-billion dollar highway development program. The continuing shift of population from the cities to the suburbs will result in a growing demand for all types of new construction such as hospitals, schools, churches, and commercial establishments. Other factors that will contribute to a high level of construction activity include anticipated high level defense requirements for construction work; increased construction requirements generated by new and expanding industries; and demands for maintenance, repair, and modernization work for a constantly increasing number of buildings and other structures.

An analysis of these and other factors affecting the volume of construction indicates an increase in construction activity of about 40 to 50 percent during the 1956–66 decade. In terms of constant (1955) dollars, total construction expenditures (including both new construction and maintenance and repair expenditures) over the next decade may reach $85 to $90 billion compared with about $60 billion in 1956.

This large increase in construction activity is expected to result in a substantial increase in the employment of building craftsmen. However, employment is expected to increase at a slower rate than expenditures. Continued technological developments in construction methods and equipment will permit greater output per construction worker. The technological changes which can be foreseen at the present time are not likely to result in large declines in employment in the large building trades. The experience of the past 50 years shows that the skilled building trades generally have been able to adapt to technological changes and continue to grow.

Employment of building trades craftsmen in maintenance jobs in factories, commercial establishments, schools, and large residential projects is also expected to increase substantially in the 1956–66 decade.

There will be differences in the rate of growth among the various building trades. Employment growth will be most rapid for bricklayers, cement and concrete masons, operating engineers, sheet metal workers, plumbers and pipefitters, and electricians and less rapid for paperhangers, painters, stonemasons, marble setters, and building laborers. Employment of carpenters will also increase substantially and this trade will continue to be the largest single occupation in the building trades. (A more complete statement covering employment opportunities in each trade is given in the discussions of individual occupations in this chapter.)

One of the principal sources of job opportunities for new workers will result from replacement needs. The building trades, with about 2.8 million skilled craftsmen in 1956, represent a very large field of work. Deaths and retirements alone will create about 50,000 to 60,000 job openings each year. Other openings will result from the need to replace experienced craftsmen who leave the building trades for other fields of work.

In July 1956, an estimated 103,080 apprentices were in registered apprentice training programs and perhaps 20,000 to 30,000 other apprentices in programs which were unregistered. Opportunities for young men to receive apprentice training will be available in all parts of the country during the 1956–66 decade. In addition, thousands of other workers will be able to enter the trades informally.

Some indication of the location of future apprenticeship opportunities is given in the following geographical distribution of registered building trades apprenticeships as of July 1956:

State	Number of apprentices
Total	103, 080
Alabama	1, 387
Arizona	1, 016
Arkansas	511
California	14, 162
Colorado	1, 223
Connecticut	2, 480
Delaware	247
District of Columbia	1, 202
Florida	2, 798
Georgia	1, 994
Idaho	352
Illinois	9, 051
Indiana	2, 149
Iowa	808
Kansas	764
Kentucky	1, 300
Louisiana	1, 439
Maine	281
Maryland	1, 487
Massachusetts	2, 548
Michigan	5, 196
Minnesota	2, 688
Mississippi	465
Missouri	2, 995
Montana	463
Nebraska	718
Nevada	328
New Hampshire	151
New Jersey	2, 289
New Mexico	569
New York	8, 689
North Carolina	1, 842
North Dakota	168
Ohio	7, 336
Oklahoma	962
Oregon	1, 013
Pennsylvania	3, 906
Rhode Island	542
South Carolina	819
South Dakota	237
Tennessee	1, 981
Texas	4, 989
Utah	595
Vermont	95
Virginia	1, 278
Washington	2, 152
West Virginia	570
Wisconsin	2, 610
Wyoming	235

Earnings and Working Conditions

Hourly wage rates paid building craftsmen are generally much higher than those paid most other skilled workers. However, because construction work is seasonal and time is lost for other reasons, average annual earnings are not as high as the hourly rates of pay indicate. Nevertheless, annual earnings of these craftsmen, as a group, compare favorably with those of other skilled workers.

The hourly rates of pay for skilled workers in the building trades vary by trade and locality. Generally, the highest hourly rates are paid in the larger communities. (Wage rates for a trade may also vary within the same city depending upon the type of work performed and the working conditions.) The average minimum union hourly wage rates as of July 1, 1956, for 22 selected occupations in 52 large cities, as reported to the Bureau of Labor Statistics, are shown below:

Trade	Average hourly rate
All building trades	$3.04
Journeymen	3.22
Asbestos workers	3.29
Bricklayers	3.62
Carpenters	3.13
Cement finishers	3.11
Electricians (inside wiremen)	3.34
Elevator constructors	3.36
Glaziers	2.93
Lathers	3.43
Marble setters	3.28
Mosaic and terrazzo workers	3.28
Painters	3.01
Paperhangers	2.92
Pipefitters	3.35
Plasterers	3.50
Plumbers	3.35
Rodmen	3.17
Roofers, composition	2.96
Roofers, slate and tile	3.08
Sheet metal workers	3.20
Stonemasons	3.50
Structural-iron workers	3.30
Tile layers	3.22
Helpers and laborers	2.29
Bricklayers' helpers	2.48
Building laborers	2.20
Composition roofers' helpers	1.96
Elevator constructors' helpers	2.42
Marble setters' helpers	2.52
Plasterers' laborers	2.55
Plumbers' laborers	2.35
Terrazzo workers' helpers	2.60
Tile layers' helpers	2.51

Union rates for these occupations are those negotiated between trade unions and employers. They do not include overtime, bonuses, and payments for special qualifications or other reasons. Average union hourly rates for many of the individual building crafts in selected cities are included in the discussion of these occupations later in this chapter.

Forty hours was the standard workweek for a majority of building trades workers in 1956. Time-and-a-half was generally paid for hours worked beyond the standard workday of 8 hours. Time-and-a-half or double-time rates were usually paid for work on Saturdays and Sundays or on holidays. Travel pay to and from work was commonly paid to building trades workers whenever their work was outside a specified local area.

A substantial proportion of organized building trades workers are included in negotiated health and insurance programs. A majority of the building trades workers in major cities are covered by health and insurance programs financed almost entirely by employer contributions. Pension plans for building trades workers have become more common in recent years.

A large proportion of skilled building trades workers are members of trade unions affiliated with the Building and Construction Trades Department of the American Federation of Labor and Congress of Industrial Organizations.

Construction work is active and sometimes strenuous but great physical strength is generally not necessary to perform the work capably. Much of the heavier work is now performed by machinery. Nevertheless, persons interested in becoming building craftsmen should be in good physical condition. Prolonged standing, bending, stooping, and working in cramped quarters are frequently necessary. Exposure to cold and inclement weather is common as much of the work is done outdoors or in partially enclosed structures. During the winter, when the buildings are sufficiently enclosed, artificial heat is commonly provided. Many persons prefer construction work to other skilled occupations because they are able to work outdoors.

Construction work is generally more dangerous than work in manufacturing, but the risk of injury is lessened considerably when proper work practices are followed. In recent years, the safety record of construction workers in contract construction work has improved.

Where To Go for More Information

Information on opportunities for apprenticeship or other types of construction employment in a particular locality may be obtained from individual construction firms, employer associations, or locals of the building trades unions. Many apprenticeship programs are supervised by local, joint union-employer committees. In these instances, an apprentice applicant may apply directly to the coordinator of the joint apprenticeship committee if there is one in his locality. In recent years, there has been a trend toward increased use of the local office of the State employment service as a source of information and a contact point for apprenticeship openings.

For more information on jobs in the building trades, a young man should write to the organizations listed below:

American Federation of Labor and Congress of Industrial Organizations,
Building and Construction Trades Department,
815 16th St., NW., Washington 6, D. C.

Associated General Contractors of America, Inc.,
Munsey Trust Bldg., Washington 4, D. C.

National Association of Home Builders,
1625 L St., NW., Washington 6, D. C.

For the names of labor organizations and trade associations concerned with specific building trades, see the individual discussions of the various building trades later in this chapter.

Carpenters

(D. O. T. 5–25.110 through .830)

Nature of Work

Carpenters saw, fit, and assemble wood, plywood, wallboard, and other materials and fasten these materials by means of glue, nails, bolts, or wood screws to form various structures. In addition, they often install linoleum, asphalt tile, and similar soft-floor coverings. They use handtools such as hammers, saws, chisels, and planes as well as power tools such as portable power saws, drills, and rivet guns.

Carpenter apprentices learn the trade through actual work experience.

Carpentry work is commonly divided into 2 broad categories—"rough" carpentry and "finish" carpentry. A skilled carpenter, however, should be able to do both types of work. In rough work, carpenters erect the wood frame buildings, including subflooring, sheathing, partitions, floor joists, studding, and rafters. They also install heavy timbers used in the building of docks, railroad trestles, and similar heavy installations. Rough carpentry also includes the building of forms to enclose concrete until it has hardened, the making of chutes for pouring wet concrete, and the erection of scaffolding and temporary buildings on the construction site. In finish work, carpenters install molding around floors and ceilings, wood paneling, cabinets, exterior and interior trim, window sash, door frames, and hardware. They also build stairs and lay floors. Finish work carpenters must be very accurate because their completed work is visible and because they often work with expensive woods.

Although a skilled journeyman is expected to know all aspects of carpentry work, there is much specialization within the trade, because of the wide scope of the work performed. For example, some carpenters specialize in installing acoustic panels on ceilings and walls. Others specialize in trimming (the installation of millwork and finish hardware), laying hardwood floors, or building stairs. Specialization is more common in the large cities; in small communities carpenters ordinarily do all types of carpentry work. In rural areas carpenters may also frequently do the work of other craftsmen, particularly painting, glazing, or roofing.

Where Employed

Most carpenters work in the construction industry and are employed mainly by contractors and home builders at the construction site. They work principally on building construction, although many are employed on highway or other nonbuilding projects. A large number do repair, alteration, or modernization work. Many carpenters alternate between wage employment for contractors and self-employment on small jobs. Many others work for Government agencies or business firms which do their own construction work. A large number of carpenters do maintenance work in factories, hotels, office buildings, and other large establishments. Carpenters are also employed in shipbuilding, in mining, and in the production of many kinds of display materials.

Carpenters are employed in almost every community in the country. Their employment distribution is generally similar to that of the Nation's population. The widespread employment of carpenters is an important consideration for young persons interested in learning this trade. Beginning carpenters can not only find jobs in their own communities but once they become journeymen they can obtain jobs in almost any part of the country.

Training, Other Qualifications, and Advancement

Completion of a 4-year apprenticeship program for carpenters is recommended by training authorities generally as the best way to learn this trade. A substantial proportion of carpenters, however, have learned the trade informally. They have picked up the trade by working for several years as helpers or handymen, observing, or being taught by, experienced carpenters. Many of these persons have gained some of the knowledge of their trade by taking correspondence or trade school courses.

Apprenticeship applicants are generally required to be at least 17 years of age; a high school education or its equivalent is desirable. Good

physical condition and manual dexterity are important assets. Many apprenticeship programs are under the supervision of local joint employer-union apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship generally consists of 8,000 hours of on-the-job training plus a minimum of 576 hours of related instruction. During the apprenticeship period the apprentice learns how to use and handle the tools, machines, and materials commonly used in the trade. He learns elementary structural design and becomes familiar with the common systems of frame and form construction. Because the work of the carpenter is basic in the construction process, the apprentice must also learn the relationship between carpentry and the other building trades.

The apprentice receives related classroom instruction in drafting and blueprint reading, mathematics applicable to layout work, and the use of woodworking machines. An illustration of a 4-year apprenticeship work schedule for construction carpenters follows:

Type of work	*Approximate hours*
Total	8,000
Form building	850
Build and place straight concrete forms; build and place irregular concrete forms; build and place concrete forms for stairways and floors, walls and columns.	
Rough framing	1,500
Floor, wall, roof, stair, scaffolding, etc., on both house and heavy construction.	
Outside finishing	1,200
Application of cornice and wall trim; set door and window frames; application of trimming fixtures; roof covering.	
Inside finishing	1,700
Application of door and window trim: fit and sand doors and windows; application of baseboards and moldings; construction and setting cases, wardrobes, stair work; flooring.	
Hardware fitting	500
Application of hardware and fittings to exterior and interior of building, doors and windows.	
Layout	750
Batterboards; partitions; doors and windows; box-out in concrete walls.	
Care and use of tools and woodworking machinery	1,000
Miscellaneous	500
Scaffolding, walkways, shoring, sheds, etc.	

Hourly wages rates for apprentices start at about 50 percent of the journeyman rate and usually increase by about 5 percent in each 6-month period until 85 to 90 percent is reached during the last period of apprenticeship. If apprentice applicants have had experience or training directly related to the trade, such as training in carpentry in a vocational school or experience in the Armed Forces, they may be given advanced apprenticeship standing.

Carpenters may advance to the position of carpenter foremen. In addition, they may become general construction foremen. Carpenters usually have greater opportunities than most building craftsmen to become general construction foremen since carpenters are more familiar with the entire construction process. Also, the proportion of self-employed among carpenters is higher than among most other skilled building trades. Some self-employed carpenters are able to expand their activities to contracting—hiring other journeymen. Adequate financial resources and a sound knowledge of business principles and practices, in addition to a knowledge of construction, are basic requirements for success as a contractor.

Employment Outlook

There will be tens of thousands of opportunities for young men to learn the carpentry trade during the late 1950's and the 1960's. A substantial increase in the employment of these workers is expected as a result of anticipated higher levels of construction activity. In addition, replacement needs will create thousands of job opportunities for new workers.

Employment of carpenters has increased rapidly in recent years. Their rate of growth has been much faster than that of the total labor force. The number of carpenters employed increased from about 550,000 in 1940 to 900,000 in 1950, and to about 1,200,000 in mid-1956. The anticipated 40 to 50 percent increase in construction expenditures in the 1956–66 decade (see discussion, p. 230), will result in continued growth in this occupation.

Technological developments have affected and are expected to continue to affect both the number and skill requirements of carpenters. Construction materials that are processed off the site and materials designed for easier and faster installa-

tions have become progressively more important. There has also been a continued trend toward a greater use of factory prefabrication of structural building components as well as entire structures. Nevertheless, a substantial increase in employment of carpenters in construction is anticipated. A growing number of carpenters will also be needed in the maintenance departments of factories, commercial establishments, large residential projects, and government agencies.

The 1.2 million carpenters comprise the largest single group of skilled workers in the country and account for about two-fifths of all building trades craftsmen. Because of the large size of this occupation replacement needs are very great. Deaths and retirements alone will create about 20,000 to 25,000 job openings annually during the 1956–66 decade. Many other openings will result from the need to replace workers who leave the trade for other reasons.

Young men who obtain all-round skill training of the kind given under apprenticeship programs will have especially favorable long-range job prospects. These workers are in much greater demand than the many persons in the trade who can do only the simpler and more routine types of carpentry work. They also have better opportunities for advancement.

Earnings and Working Conditions

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for carpenters in the 52 large cities surveyed was $3.13. Among the individual cities the minimum union hourly wage rates ranged from $2.25 in Charlotte, N. C., to $3.65 in Newark and New York, as shown in the following tabulation (wage rates for this trade may vary within the same city depending upon the type of work performed and the working conditions):

Atlanta, Ga	$2.80
Baltimore, Md	2.95
Birmingham, Ala	2.60
Boston, Mass	3.05
Buffalo, N. Y	3.32
Charlotte, N. C	2.25
Chicago, Ill	3.35
Cincinnati, Ohio	3.30
Cleveland, Ohio	3.58
Columbus, Ohio	3.00
Dallas, Tex	$2.88
Dayton, Ohio	3.10
Denver, Colo	2.98
Des Moines, Iowa	3.00
Detroit, Mich	3.20
Erie, Pa	3.15
Grand Rapids, Mich	2.88
Houston, Tex	2.98
Indianapolis, Ind	2.88–3.23
Jacksonville, Fla	2.60
Kansas City, Mo	2.90
Knoxville, Tenn	2.73
Little Rock, Ark	2.75
Los Angeles, Calif	3.00
Louisville, Ky	3.00
Memphis, Tenn	2.55
Milwaukee, Wis	3.15
Minneapolis–St. Paul, Minn	3.00
Newark, N. J	3.65
New Haven, Conn	3.10
New Orleans, La	2.68
New York, N. Y	3.65
Oklahoma City, Okla	2.73
Omaha, Nebr	2.93
Peoria, Ill	3.21
Philadelphia, Pa	3.39
Pittsburgh, Pa	2.99–3.33
Portland, Oreg	2.80
Providence, R. I	2.73
Richmond, Va	2.30
Rochester, N. Y	3.25
St. Louis, Mo	2.95–3.25
Salt Lake City, Utah	2.75
San Antonio, Tex	2.75
San Francisco–Oakland, Calif	3.00
Scranton, Pa	2.75
Seattle, Wash	2.80
Spokane, Wash	2.90
Springfield, Mass	2.83
Syracuse, N. Y	3.05
Toledo, Ohio	3.33
Washington, D. C	3.23

Because of the seasonal nature of much of construction work and because of time lost for other reasons, the average annual earnings of carpenters are not as high as their hourly rates of pay indicate.

A large proportion of carpenters are members of the United Brotherhood of Carpenters and Joiners of America. A small number are members of other unions. Union-employer contracts covering carpenters often provide health insurance and pension benefits financed either entirely by employers or jointly by the workers and employers.

Like other building trades the work of the carpenter is active and sometimes strenuous, but exceptional physical strength is not required. Many

young persons like carpentry because they are able to work out of doors. Prolonged standing as well as climbing and squatting are often necessary. Carpenters risk injury from slips or falls, from contact with sharp or rough materials, and from the use of woodworking machines.

Where To Go for More Information

A young man who wishes to obtain further information regarding carpentry apprenticeships or work opportunities in this trade should contact the carpentry contractors or general contractors in his area, a local of the carpenters' union (United Brotherhood of Carpenters and Joiners of America) or a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities. Some local employment services screen applicants and give aptitude tests.

Further information on apprenticeship in this trade is also available from:

Associated General Contractors of America, Inc.,
Munsey Bldg., NW., Washington 4, D. C.

United Brotherhood of Carpenters and Joiners of America,
Carpenters Bldg., 222 Michigan St., Indianapolis 4, Ind.

National Association of Home Builders,
1625 L St., NW., Washington 6, D. C.

Painters and Paperhangers

(D. O. T. 5-27.010; 5-28.100)

Nature of Work

Painters prepare surfaces and then apply paint, varnish, enamel, lacquer, and similar materials to the surfaces of buildings and other structures. Paperhangers cover room interiors with paper, fabric, or similar materials. Painting and paperhanging are distinct skilled building trades. However, many of these craftsmen do both types of work.

One of the important duties of the painter—especially in repainting—is to prepare the surface. Rough spots must be sandpapered, dust brushed off, grease removed, nail holes filled, and loose paint removed by scraping or by heating with a blowtorch and then scraping. Often, surfaces must be covered with a prime coat or sealer to provide a suitable surface or base on which to apply the new paint. Paint is applied to many kinds of materials, including wood, structural steel, and clay products, generally by means of a brush, spray gun, or roller.

A painter must be skilled in handling brushes and other painting tools, in order to apply paint thoroughly, uniformly, and rapidly to any type of surface. In addition, he must be able to mix paints, match colors, and have a knowledge of color harmony. He must also know the characteristics of common types of paints and finishes from the standpoints of durability, suitability for different purposes, and ease of handling and application. A painter must know how to erect the necessary scaffolding from which he often works.

Painters use spray guns to paint surfaces or objects which are difficult to paint with a brush such as lattices, cinder and concrete block, and radiators. They also use spray guns on large areas which can be sprayed with a minimum of preparation. When using a roller (a rotating applicator covered with soft material) the painter rolls the applicator over the surface to be covered.

In paperhanging, the worker first applies "sizing" (a prepared material which prevents suction in the plaster and assures better adhesion of the paper to the surface being covered). He then measures the area to be covered and cuts the paper to size. He mixes a paste and applies it to the reverse side of the paper. (When working with other wall coverings, such as those which are fabric-coated, the paperhanger applies an adhesive instead of a paste.) The paste-coated paper is then placed on the wall or ceiling in strips and smoothed into place with a dry brush. The paperhanger matches the adjacent edges of strips of figured paper, cuts overlapping ends, and smooths the seams between strips with a roller or other special tool. In redecorating work it may be necessary to remove the old paper by soaking or, if there are many layers, by steaming. In many cases, it is also necessary for paperhangers to do minor plaster patching in order to get a smooth surface for the paper.

Where Employed

Most painters and paperhangers work in the construction industry, usually at the building site. They work mainly for contractors engaged in new building construction work. Substantial numbers of painters and paperhangers are also employed by contractors to do repair, alteration, or modernization work. Hotels, office buildings, utility companies, manufacturing firms, school boards and other government units, and other organizations that own extensive property, commonly employ maintenance painters. When interior redecorating involves papering also, as in hotels or apartment buildings, usually the maintenance painters may also do the paperhanging.

In mid-1956, more than 400,000 painters and about 20,000 to 25,000 paperhangers were employed in these trades. Their employment was distributed throughout the country in about the same geographic pattern as building trades workers generally. New York, California, Texas, Pennsylvania, and Illinois had especially large concentrations of these workers.

Training, Other Qualifications, and Advancement

Most training authorities agree that completion of a 3-year formal apprenticeship is the best way to become a journeyman (skilled) painter or journeyman paperhanger. A substantial proportion of painters and paperhangers, however, have learned the trade informally. They have picked up the trade by working for several years as helpers or handymen, observing or being taught by experienced craftsmen. Workers without formal apprentice training have gained acceptance as journeymen more easily in these crafts than in most of the other building trades. However, the high level of competence achieved by journeymen through apprentice training increases their employment opportunities and enhances their status in any craft that has a large number of workmen who are not thoroughly qualified.

Apprentice applicants are generally required to be between the ages of 16 and 21 and in good physical condition. A high school education is preferred although not essential. Applicants should have manual dexterity and a discerning color sense. They should not be allergic to paint fumes or to the various materials used in these trades. Many apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship for painters and paperhangers generally consists of 6,000 hours of on-the-job training plus related instruction. Many apprenticeships combine painting and paperhanging. During the apprenticeship period the apprentice learns how to use and handle the tools, equipment, and materials commonly used in the trade. The trainee learns the relationship between his work and the work performed by the other building trades. He also receives related classroom instruction in color harmony, paint chemistry, estimating costs, and how to make, mix, and match paints.

An illustration of a 3-year apprenticeship program for painters and paperhangers follows:

Sandpapering, puttying, and priming of woodwork
Preparing and sizing of walls
Removing of wallpaper, calcimine, paint
Calcimining and whitewashing
Finishing walls with flat coat and enamel
Finishing wood trim with oil, enamel, or varnish
Preparing stains, staining, bleaching woodwork
Pore filling and shellacking
Lead stippling and starching walls
Outside painting
Applying various types of wall coverings
Matching and mixing colors
Rag and sponge stippling
Blending and glazing walls and woodwork
Graining, marbling, metal leafing
Stenciling, striping, spackling
Making putty
Operation, care and use of all tools and equipment connected with the trade
Rigging, staging and scaffolding

Hourly wage rates for apprentices start at approximately 50 percent of the journeyman rate and increase periodically until the journeyman rate of pay is reached upon completion of apprenticeship. If apprentice applicants have had experience directly related to the trade, such as experience in the Armed Forces, the applicants may be granted advanced apprenticeship standing.

Painters and paperhangers may advance to the position of foremen. They may also advance to jobs as estimators for painting and decorating contractors, computing material requirements and labor costs. Some become superintendents on large

contract painting jobs, or they may start their own business as painting and decorating contractors. Success as a contractor, however, depends largely on having adequate financial resources and a sound knowledge of business principles and practices.

Employment Outlook

There will be thousands of opportunities for young men to learn these trades during the late 1950's and the 1960's. Most of these opportunities will arise from the need to replace experienced workers who die, retire, or leave the trades for other reasons.

The employment of painters and paperhangers has increased at a slower rate than most of the other building trades in recent years. It increased by about 25 percent in the period 1940–56, compared with a growth of more than 60 percent for the skilled building trades as a whole.

Despite the anticipated large expansion of construction activity during the 1956–66 decade (see discussion, p. 229) employment of painters will continue to grow slowly; employment of paperhangers will increase slightly or remain about the same.

Technological developments have affected and are expected to continue to affect both the number and skill requirements of painters. New types of paint which are more easily applied and have improved "covering power" have made it easier for inexperienced workers to do work which meets standards of acceptability of some consumers. Spray painting, which is used particularly on large, unbroken interior surfaces, requires fewer painters to do the same amount of work. Moreover, many items formerly painted at the building site now come from a factory or shop with a prime coat and often with a final coat. Aluminum building products which often require no painting have become increasingly common in recent years. These and other factors are expected to continue to slow the growth of employment of painters.

Employment prospects of paperhangers will continue to be limited by the substitution of paint for wallpaper as a covering for interior walls in residential and commercial buildings. The more widespread use of fabric wall covering, however, may improve somewhat the employment outlook for these workers.

Because of the large size of the painter and paperhanger group, replacement needs are very great. Deaths and retirements alone will create about 8,000 to 10,000 job openings annually during the 1956–66 decade. Many other openings will result from the need to replace experienced workers who leave the trades for other reasons.

Earnings and Working Conditions

The Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate in 52 large cities survey was $3.01 for painters and $2.92 for paperhangers. Among the individual cities the minimum union hourly wage rates ranged from $1.75 in Charlotte, N. C., for both painters and paperhangers, to $3.35 for painters in Newark and $3.28 for paperhangers in Chicago, as can be seen in the following tabulation (wage rates for these trades may vary within the same city depending upon the type of work performed and the working conditions):

	Painters	*Paperhangers*
Atlanta, Ga	$2.75	$3.00
Baltimore, Md	2.68	2.68
Birmingham, Ala	2.75	2.75
Boston, Mass	2.65	---
Buffalo, N. Y	3.00	3.00
Charlotte, N. C	1.75	1.75
Chicago, Ill	3.28	3.28
Cincinnati, Ohio	2.73–3.03	2.73–2.88
Cleveland, Ohio	3.15	3.15
Columbus, Ohio	2.71	2.71
Dallas, Tex	2.81	2.81
Dayton, Ohio	3.00	3.27
Denver, Colo	2.90	2.90
Des Moines, Iowa	2.75	2.75
Detroit, Mich	3.08	3.08
Erie, Pa	2.70	2.77
Grand Rapids, Mich	2.60	2.85
Houston, Tex	2.75	2.75
Indianapolis, Ind	3.00	3.00
Jacksonville, Fla	2.38	2.63
Kansas City, Mo	2.90	2.90
Knoxville, Tenn	2.50	---
Little Rock, Ark	2.31	2.31
Los Angeles, Calif	3.01	3.13
Louisville, Ky	2.80	2.25
Memphis, Tenn	2.56	2.56
Milwaukee, Wis	2.75	---
Minneapolis–St. Paul, Minn	2.85	2.85
Newark, N. J	3.35	---
New Haven, Conn	2.90	3.15
New Orleans, La	2.40	2.40
New York, N. Y	2.85–3.25	---
Oklahoma City, Okla	2.60	2.60
Omaha, Nebr	2.50	2.50
Peoria, Ill	2.93	2.93
Philadelphia, Pa	2.90	2.64

	Painters	*Paperhangers*
Pittsburgh, Pa	$3.00	$3.00
Portland, Oreg	2.75	2.88
Providence, R. I	2.50	2.50
Richmond, Va	2.15	2.15
Rochester, N. Y	3.03	3.03
St. Louis, Mo	3.09	3.09
Salt Lake City, Utah	2.50	2.55
San Antonio, Tex	2.50	2.50
San Francisco–Oakland, Calif	3.10	3.10
Scranton, Pa	2.38	2.38
Seattle, Wash	2.81	2.81
Spokane, Wash	2.76	2.76
Springfield, Mass	2.70	2.70
Syracuse, N. Y	2.70	---
Toledo, Ohio	3.02	3.02
Washington, D. C	3.05	3.05

A large proportion of painters and paperhangers are members of the Brotherhood of Painters, Decorators and Paperhangers of America. A small number are members of other unions. Union-employer contracts covering these workers usually provide health insurance and pension benefits, either financed entirely by employers or jointly by the workers and employers.

Painters and paperhangers are often required to stand for long periods of time, to climb, and to bend at their work. A painter must have strong arms because much of the work is done with arms raised overhead. Painters and paperhangers risk injury from slips or falls from ladders and scaffolds.

Where To Go for More Information

A young man who wishes to obtain further information concerning painting and paperhanging apprenticeships or work opportunities in these trades should apply to a painting and decorator contractor in his area; a local of the Brotherhood of Painters, Decorators and Paperhangers of America; or a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Brotherhood of Painters, Decorators and Paperhangers of America,
217–219 North Sixth St., Lafayette, Ind.

Painting and Decorating Contractors Association of America,
540 North Michigan Ave., Chicago 11, Ill.

National Association of Home Builders,
1625 L St., NW., Washington 6, D. C.

Plumbers and Pipefitters

(D. O. T. 5–30.010, .026, .210, .410)

Nature of Work

Plumbers and pipefitters are highly skilled craftsmen who install, alter, and repair pipe systems. These systems provide steam heat, water or other liquids, air, gas, or waste disposal facilities for residences, industrial and commercial buildings, and other structures.

In assembling pipe systems, plumbers and pipefitters bend, weld, bronze, and thread pipes and fittings. They also install fixtures, appliances, radiators, and heating units. They cut openings in walls for pipes and prepare the pipe for installation by cutting, reaming, and threading. When pipes are joined, the joints are caulked, soldered, threaded, or wiped, that is, molten solder is poured over the joint, spread, and then shaped with a cloth. After a pipe system is installed, the plumber tests for leaks by filling the pipes with water under pressure and checks the joints for pressure drop with a gage.

Plumbers and pipefitters use handtools, such as wrenches, reamers, drills, braces and bits, hammers, chisels, and saws. They also use gas or gasoline torches and welding equipment in their work. Power machines are often used to cut, bend, and thread pipes. Hand-operated hydraulic benders are also used to bend pipe.

This broad field of work is sometimes considered to be a single trade. However, plumbers and pipefitters do somewhat different types of work, particularly in large cities. Plumbers mainly install water, gas, and waste disposal systems, particularly those which must be connected to public utility systems. Pipefitters install heating lines, such as hot water, and steam fitting systems, especially in industrial and commercial establishments. For example, they install pipes for ammonia systems in refrigeration plants, automatic sprinkler systems, lines for compressed air and industrial gages, and complex pipe systems in oil refineries, chemical plants, and food plants.

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Repair work keeps many plumbers busy, even during the slack seasons for new construction.

Some plumbers and pipefitters specialize in gas fitting and steam fitting. Gas fitters install and maintain the gas fittings and the central gas main extensions which connect the main gas line to homes. Steam fitters assemble and install steam or hot water heating systems.

Where Employed

Most plumbers and pipefitters are employed by plumbing and pipefitting contractors in new building construction, mainly at the construction site. A substantial proportion of plumbers are self-employed or work for plumbing contractors doing repair, alteration, or modernization work. Some plumbers are employed in the installation of pipe systems for government agencies and public utilities, and some work in the construction of ships and aircraft. Others are employed as maintenance workers in industrial and commercial establishments. Pipefitters, in particular, are employed as maintenance personnel in the petroleum, chemical, and food-processing industries where the industrial operations include the processing of fluids through pipes.

Jobs for plumbers and pipefitters are found in almost every community in the country, but they are concentrated in the highly populated and industrialized areas. Most journeymen who specialize in steam and hot water heating systems are employed in large northern cities.

Training, Other Qualifications, and Advancement

Most training authorities recommend a 5-year apprenticeship program for plumbers and pipefitters as the best way to learn all the aspects of the trade. A substantial proportion of these craftsmen, however, have learned the trade informally. They have picked up the trade or one aspect of the trade by working for several years as helpers, observing or being taught by experienced craftsmen. Many of these persons have gained some of their knowledge of the trade by taking trade school or correspondence courses.

Apprentice applicants are generally required to be between the ages of 16 and 25; a high school education or its equivalent, including courses in mathematics, physics, and chemistry, is desirable. Applicants are often required to take aptitude tests, particularly to determine whether they have the high degree of mechanical aptitude required in this field.

Most apprenticeship training programs for plumbers and pipefitters are conducted under written agreements between the apprentices and local, joint employer-union apprenticeship committees, which also supervise the training. The apprenticeship committee determines the need for apprentices in the locality, establishes minimum apprenticeship standards of training and, if necessary, schedules a rotating work program. This program is designed to give the apprentice diversified training by having him work for several plumbing or pipefitting contractors. Under formal apprenticeship programs, the apprentice is registered with the appropriate State apprenticeship agency or the United States Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program usually consists of 10,000 hours of on-the-job training plus related instruction. During the apprenticeship period the apprentice learns how to use and handle the tools, machines, and materials commonly used in the trade. The apprentice also receives related classroom instruction in such subjects as drafting and blueprint reading; mathematics applicable to layout work; applied physics and chemistry; the use, care, and maintenance of machines and equipment used in the trade; and the local building laws and regulations which apply to the trade.

An illustration of a combined plumbing and pipefitting 5-year apprenticeship work schedule follows:

Type of work	*Approximate hours*
Total	10,000
Install waste and vent pipes	1,700
Install water pipe and hot water heating systems	1,800
Install steam heating systems	1,500
Install plumbing fixtures, set radiators, and heating units	750
Install pumps	300
Install stokers, oil burners, gas furnaces, and piping	200
Install and pipe septic tanks, cesspools, and sewers	100
Install panel and radiant heating systems	100
Install air-conditioning systems	100
Install powerplant piping systems	1,000
Testing of systems	300
Repair work and boiler replacement	1,000
Install and maintain control equipment	50
Shop work, use and care of tools, records, operation of pipe machine, and welding	1,100

Hourly rates of apprentices in this trade start at about 50 percent of the journeyman rate and increase by about 5 percent in each 6-month period until a rate of 95 percent is reached during the last period of the apprenticeship. If apprentice applicants have had prior experience or training directly related to the trade they may, in some instances, be given advanced standing and pay. This experience or training may have been obtained in the Armed Forces or through courses in public or private schools.

In some localities, a journeyman's license is required for plumbers. To obtain this license a person must pass a special examination to demonstrate his knowledge of the local building codes. The examination also tests his all-round knowledge of the trade.

Some journeymen plumbers and pipefitters may become foremen for a plumbing contractor. Many journeymen go into business for themselves. As they expand their activities, they may employ other workers and become plumbing and pipefitting contractors. In some localities, contractors are required to obtain a master plumber's (journeyman's) license. Basic requirements for success as a contractor are adequate financial resources and a sound knowledge of business principles and practices. A thorough knowledge of the pipe trade and an understanding of construction principles are also necessary.

Employment Outlook

A continued rapid rise in employment in this occupation is expected during the late 1950's and the 1960's. The rate of growth in this field will be much faster than that for the Nation's total labor force. In addition to openings resulting from the increase in employment, many job opportunities for new workers will arise as a result of replacement needs.

Employment in this field has increased rapidly in recent years—from about 174,000 in 1940, to 274,000 in 1950, and to an estimated 315,000 in mid-1956. Several factors contribute to the expectation of a continued rapid rise in employment in this trade. Most important of these is the anticipated 40 to 50 percent increase in construction activity in the 1956–66 decade. (See discussion, p. 230.) Furthermore, plumbing and pipefitting has become increasingly important in many types of construction, particularly residential building. For example, there has been a trend toward more bathrooms per dwelling unit. Moreover, the more widespread installation of appliances such as washing machines, dryers, and waste disposals requires more plumbing work. The increasing number of installations of automatic heating systems will also create more work for these craftsmen.

In addition, industrial pipe work is becoming more important in industry generally and requires more of these craftsmen for installation and maintenance work. For example, many industries, particularly the chemical and petroleum industries, which use extensive pipe work for their processing activities, are expected to expand their facilities substantially during the 1956–66 decade. Also, those industries which are automating their production activities will require more pipefitting work. The increasing industrial activities related to atomic energy and the greater use of refrigeration and air-conditioning equipment will also result in more work for plumbers and pipefitters. On the other hand, some technological developments, such as the growing use of factory prefabricated plumbing assemblies, may limit, to some extent, the growth in the number of jobs for plumbers and pipefitters.

In addition to job opportunities resulting from the growth in the trade, the need to replace experienced workers who die, retire, or leave the trade for some other reason will create thousands of job openings for new workers each year.

Deaths and retirements alone will create from 6,000 to 7,000 job openings annually during the 1956–66 decade.

Earnings and Working Conditions

Hourly wage rates for plumbers and pipefitters are among the highest in the skilled building trades and among skilled workers generally. Another important consideration for young persons considering plumbing and pipefitting as a career is that annual earnings of these workers are among the highest in the building trades because plumbing and pipefitting are affected less by seasonal factors than are most other building crafts.

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wages in the building trades showed that, as of July 1, 1956, the average union hourly rate for plumbers and pipefitters in 52 large cities surveyed was $3.35, compared with $3.22 for all journeymen in the building trades. Among the individual cities the minimum union hourly wage rates ranged from $2.75 in Richmond, Va. for both plumbers and pipefitters to $3.75 in Newark, New York, and Philadelphia for plumbers and $3.85 in New York for pipefitters, as shown in the following tabulation (wage rates for these trades may vary within the same city depending upon the type of work performed and the working conditions):

	Pipefitters	*Plumbers*
Atlanta, Ga	$3.20	$3.20
Baltimore, Md	3.20	3.20
Birmingham, Ala	3.05	3.05
Boston, Mass	3.20	3.15
Buffalo, N. Y	3.30	3.28
Charlotte, N. C	2.85	2.85
Chicago, Ill	3.37	3.35
Cincinnati, Ohio	3.50	3.28
Cleveland, Ohio	3.38	3.38
Columbus, Ohio	3.25	3.25
Dallas, Tex	3.10	3.10
Dayton, Ohio	3.25	3.25
Denver, Colo	3.17	3.17
Des Moines, Iowa	3.25	3.25
Detroit, Mich	3.46	3.46
Erie, Pa	3.10	3.10
Grand Rapids, Mich	3.38	3.38
Houston, Tex	3.40	3.10
Indianapolis, Ind	3.30	3.30
Jacksonville, Fla	3.10	3.10
Kansas City, Mo	3.15	3.30
Knoxville, Tenn	3.08	3.08
Little Rock, Ark	3.08	3.08
Los Angeles, Calif	3.43	3.53
Louisville, Ky	$3.18	$3.18
Memphis, Tenn	3.13	3.13
Milwaukee, Wis	3.21	3.21
Minneapolis–St. Paul, Minn	3.00	3.00
Newark, N. J	3.75	3.75
New Haven, Conn	3.25	3.25
New Orleans, La	3.05	3.05
New York, N. Y	3.85	3.75
Oklahoma City, Okla	3.15	3.15
Omaha, Nebr	3.20	3.20
Peoria, Ill	3.35	3.35
Philadelphia, Pa	3.75	3.75
Pittsburgh, Pa	3.43	3.43
Portland, Oreg	3.25	3.25
Providence, R. I	3.15	3.15
Richmond, Va	2.75	2.75
Rochester, N. Y	3.17	3.17
St. Louis, Mo	3.55	3.55
Salt Lake City, Utah	3.00	3.00
San Antonio, Tex	3.18	3.18
San Francisco–Oakland, Calif	3.45–3.69	3.33–3.45
Scranton, Pa	3.10	3.10
Seattle, Wash	3.15	3.15
Spokane, Wash	3.15	3.15
Springfield, Mass	3.05	3.10
Syracuse, N. Y	3.23	3.16
Toledo, Ohio	3.40	3.40
Washington, D. C	3.51	3.41

A large proportion of plumbers and pipefitters are members of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U. S. and Canada. Some are members of other unions. Union-employer contracts covering plumbers and pipefitters often provide health insurance and pension benefits either financed entirely by employers or jointly by the workers and employers.

The work of the plumber-pipefitter is active and sometimes strenuous, as in the other building trades. Frequently, he stands for prolonged periods and occasionally he squats or works in cramped or in other uncomfortable positions because much of the work is done in relatively inaccessible places. Since most of the work is indoors, there is less exposure to unfavorable weather conditions compared with many other building trades.

Workers in this trade risk the danger of falls from ladders, cuts from sharp tools, and burns from hot pipes or steam. The number of injuries per million man-hours worked by employees of plumbing, heating, and air-conditioning contractors in the contract construction industry is lower than that for contract construction as a whole, but higher than the average for production workers in manufacturing industries.

Where To Go for More Information

A young man who wishes to obtain further information concerning plumber or pipefitter apprenticeships or work opportunities in the trade should apply to a plumbing, heating, and air-conditioning contractor in his area, a local of the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada, or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities. Some local employment service offices provide such services as screening applicants and giving aptitude tests.

Additional information may be obtained from:

Mechanical Contractors of America,
30 Rockefeller Plaza, Suite 1843, New York 20, N. Y.

National Association of Plumbing Contractors,
1016 20th St., NW., Washington 6, D. C.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the U. S. and Canada,
United Association Bldg.,
901 Massachusetts Ave., NW., Washington 1, D. C.

National Association of Home Builders,
1625 L St., NW., Washington 6, D. C.

Operating Engineers (Construction Machinery Operators)

(D. O. T. 5–23.010 through .920, 5–72.910, 5–73.010 through .520, 7–23.010 through .120, .300 through .399, .500 through .599, and .900 through .999)

Nature of Work

Operating engineers operate, maintain, and repair the various types of power-driven construction machinery. Included among these machines are power shovels, cranes, derricks, hoists, pile drivers, concrete mixers, paving machines, trench excavators, bulldozers, tractors, and pumps. Some of these machines, such as bulldozers, are relatively simple to operate, but others, such as large cranes, are complex and require coordination of numerous controls. Thus, the range of skills is wider among operating engineers than among journeymen in any other building trade.

The broad range of skill requirements in this trade may be illustrated by describing the work performed by operating engineers in handling two types of machines—a crane and an earth-boring machine. The crane operator manipulates various pedals and levers to rotate the crane on its chassis and to raise and lower the crane boom and the load line. The operator manipulates a number of different attachments to the crane boom for various construction purposes. For example, he manipulates buckets for excavation work, pile drivers to drive steel beams, wood and concrete piling into the ground, and wrecking balls for demolition work. Good coordination, skill in precision handling of heavy equipment, and judgment in estimating proper load size are among the essential aspects of the crane operator's job. By contrast, the operation of earth-boring machines that dig holes for poles or posts is one of the less skilled tasks performed by operating engineers. The operator sets the proper auger (drill) in the spindle, starts the machine, and stops it when the auger has penetrated to the proper depth.

Operating engineers are often identified by titles describing the types of machines they operate—for example, cranemen, bulldozer operator, or derrick operator. However, the more experienced operating engineers can generally handle a variety of construction machinery. These operators work only on the more complex types of machines, when jobs requiring such equipment are available, because higher wage rates are paid for the operation of such machines.

Where Employed

Most operating engineers are employed in construction work. They work for contractors engaged in highway, dam, airport, and other large-scale engineering projects. They are also employed on large building projects requiring extensive excavating, grading, and landscaping. Operating engineers also work on small jobs, hoisting concrete, structural steel, and other materials. Others are employed by utility companies, manufacturers, and other business firms which do their own construction work, as well as by State and local public works and highway departments. Relatively few operating engineers are self-employed. Those who are self-employed are owner-operators of equipment such as bulldozers and cranes.

In addition to construction work, operating engineers are employed in factories and mines. In some cases, the duties performed by these machine operators are about the same as those in construction work. For example, operation of a crane to unload cars of coal at a factory or powerplant is very similar to operation of a crane to unload cars of sand and gravel for a paving job. On the other hand, the nature of the work of a steel pourer (craneman) in a steel mill differs considerably from a crane operator in the construction industry.

Operating engineers are employed in every section of the country, but mainly in the larger urban areas. This work, however, may take them to remote locations where highway construction and heavy engineering construction, such as dams, are being built. The geographical distribution of employment in this occupation is much the same as for the building trades generally. (See discussion, p. 227.)

Training and Other Qualifications

Formal apprenticeship programs for operating engineers are available in a few localities. For the most part, however, entrance into construction machinery operating jobs is informal. A young man with an aptitude for working with machinery and with some relevant experience such as truck-driving, may begin work as an oiler or a helper, or he may get a job operating one of the simpler machines, such as an air compressor. As openings occur he may be given a chance to operate somewhat more complicated machines, such as bulldozers or rollers. After some experience operating these machines, he is given the opportunity to operate the more complex machines. Often, informal instruction is given to new personnel by experienced operators. Large contractors often have a wide range of construction equipment, thus affording opportunities to learn the operation of successively more complex equipment.

Employment Outlook

A continued rapid rise in employment of construction machinery operators is expected during the late 1950's and the 1960's as a result of the anticipated increase in the level of construction activity. In particular, the growing volume of highway construction resulting from the Federal Government's long-range multi-billion dollar highway development program, will provide thousands of job opportunities for operating engineers. Moreover, the trend in the postwar period toward the increasing use of construction machinery shows every indication of continuing. Larger, more specialized, and more complex machines, particularly those used in earth-moving, as well as smaller machines suitable for small construction projects, are continually being developed and are expected to be used to a greater extent. The greater mechanization of material movement in factories and mines should also result in growing employment of these workers outside of construction.

In addition to job openings resulting from the expected growth of employment in this occupation, the need to replace experienced construction machine operators who die, retire, or leave the trade for other reasons will create many job opportunities for new workers. Deaths and retirements alone will create about 3,000 to 4,000 job openings annually in the 1956–66 decade.

Earnings and Working Conditions

The wage rate structure for operating engineers is more complicated than for any other construction trade. Hourly rates are established not only for different types of machines, but often for machines of the same type but of different capacity. Moreover, in some cases there are different rates for the same machine, depending upon the type of construction for which it is used. The wage scale also varies among different parts of the country and the operators of machines having the top wage rates in one area do not necessarily receive the top wage rates in other areas.

The following tabulation based on the United States Department of Labor's Bureau of Labor Statistics' survey of union minimum wage rates in the building trades in 52 large cities, as of July 1, 1956, shows the minimum union hourly wage rates paid to two classifications of construction machinery operators—shovel and bulldozer operators (shovel operators are generally among the highest paid construction machinery operators). (Wage rates for these trades may vary within the same city depending upon the type of work performed and the working conditions.)

	Shovels [1]	Bull-dozers [1]
Atlanta, Ga	$3.05	$2.53
Baltimore, Md	3.40	2.60
Birmingham, Ala	2.70	2.56
Boston, Mass	3.50	3.13
Buffalo, N. Y	3.39	----
Charlotte, N. C	2.65–2.90	2.35
Chicago, Ill	3.60	3.00
Cincinnati, Ohio	3.33	3.08
Cleveland, Ohio	3.58	3.33
Columbus, Ohio	3.33	3.08
Dallas, Tex	----	3.00
Dayton, Ohio	3.36	3.08
Denver, Colo	2.93	----
Des Moines, Iowa	3.10	3.10
Detroit, Mich	3.30	3.30
Erie, Pa	3.50	2.98
Grand Rapids, Mich	3.18	3.08
Houston, Tex	----	3.25
Indianapolis, Ind	3.18	----
Jacksonville, Fla	2.50	2.00
Kansas City, Mo	2.85–3.10	----
Knoxville, Tenn	2.83	2.58
Little Rock, Ark	2.80	2.55
Los Angeles, Calif	3.30	3.05
Louisville, Ky	3.15	3.15
Memphis, Tenn	2.70	2.45
Milwaukee, Wis	3.31	2.92–3.14
Minneapolis-St. Paul, Minn	3.17	2.85
Newark, N. J	4.20	----
New Haven, Conn	3.00	2.65
New Orleans, La	2.88	2.88
New York, N. Y	4.15	3.28
Oklahoma City, Okla	2.65–2.90	2.60
Omaha, Nebr	3.00	2.55
Peoria, Ill	----	3.33
Philadelphia, Pa	3.79	3.16
Pittsburgh, Pa	3.60	3.40
Portland, Oreg	2.90–3.38	----
Providence, R. I	3.25	----
Richmond, Va	2.66	2.20
Rochester, N. Y	3.48	3.13
St. Louis, Mo	3.33	----
Salt Lake City, Utah	2.85	----
San Antonio, Tex	----	2.95
San Francisco–Oakland, Calif	3.26	----
Scranton, Pa	$3.69	$3.06
Seattle, Wash	3.36	3.00
Spokane, Wash	3.10–3.45	----
Springfield, Mass	3.00	2.55
Syracuse, N. Y	3.43	2.88
Toledo, Ohio	3.40	3.12
Washington, D. C	3.43	2.88

[1] Wage rates in individual cities may not apply to comparable categories of construction machinery.

A large proportion of operating engineers are members of the International Union of Operating Engineers. Union-employer contracts covering these workers, in some areas, provide health insurance and pension benefits, either financed entirely by the employers or jointly by the workers and employers.

Much of the operating engineer's work is performed outdoors. The work is active and sometimes strenuous. The operation of some machines, particularly bulldozers and some types of scrapers, is physically wearing because the constant movement of the machine shakes or jolts the operator.

Where To Go for More Information

A young man who wishes to obtain further information regarding work opportunities in this trade should apply to general contractors in his area and to the local of the International Union of Operating Engineers. In addition, the local office of the State employment service is a source of information and a contact point for employment opportunities.

Additional information may be obtained from:

Associated General Contractors of America, Inc., Munsey Bldg., NW., Washington 4, D. C.

International Union of Operating Engineers, 1125 17th St., NW., Washington 6, D. C.

Bricklayers

(D. O. T. 5–24.000 through .199)

Nature of Work

Bricklayers, sometimes called brickmasons, are skilled craftsmen who construct walls, partitions, fireplaces, chimneys, and other structures from brick or other masonry materials. They also install the brick lining of kilns and industrial furnaces. In addition to laying brick, they build structures with concrete block, cinder block, structural tile, terra cotta and gypsum block.

In laying brick, a bricklayer first spreads a layer or "bed" of soft mortar. After applying mortar to one end of a brick, he places it on the bed of mortar and taps it with a trowel into the desired position. Then he cuts or scrapes off the excess mortar. When necessary, he breaks bricks with

Bricklayers laying brick and measuring opening for window frame.

a trowel or brick hammer to fit spaces too small for whole bricks. As the work progresses, he checks the vertical and horizontal alinement of each course (row) with a gage line (tightly stretched cord) and mason's level. Using the point of a trowel or a special finishing tool, he finishes the mortar between the bricks to achieve a neat appearance. If two or more thicknesses of brick are being laid the brickmason lays a "bond" course at regular intervals, that is, he arranges a row of brick crosswise or in another "bond" pattern in order to tie the bricks together. When the bricklayer works with concrete block, structural tile, or other masonry material, the work is essentially the same.

Bricklaying requires careful, accurate work so that the brick structure will have a neat and uniform appearance and the rows of brick will line up with windows, doors, or other openings without excessive cutting of brick. The tools of the trade are almost all handtools, including chisels, trowels, jointers (a narrow tool used to shape mortar joints), bricklayer's hammers, gage lines, plumb bobs, and mason's levels. Power saws for cutting brick are also used. Journeymen (skilled) bricklayers are usually assisted by hod carriers or helpers who supply them with bricks and other materials, mix mortar, and set up and move scaffolding.

Where Employed

The great majority of bricklayers work mainly on new building construction. Some are employed in sewer construction work in which they construct manholes and catch basins. Repair and maintenance work is much less important for bricklayers than for other skilled building trades. However, bricklayers do a considerable amount of alteration work, especially in the larger cities where construction of fire resistant partitions, store front remodeling, and similar modernization work, is often done.

Bricklayers also work for industrial establishments, such as factories making glass or steel, where furnaces and kilns require special fire brick and refractory brick linings. For example, in steel manufacturing, the bricklayer lines converters, cupolas, ladles, and tapping spouts. Bricklayers must have additional training to do refractory brick work.

Jobs for bricklayers are found throughout the country. Their employment, however, is concentrated in the more highly populated and industrialized areas.

Training, Other Qualifications, and Advancement

Most training authorities agree that completion of a 3- or 4-year apprenticeship is the best way to learn this trade. However, a substantial proportion of bricklayers have learned the trade informally. They have picked up the trade by working for several years as helpers or hod carriers, observing or being taught by experienced bricklayers. Many of these persons have gained some knowledge of their trade by taking trade school courses.

Apprenticeship applicants are generally required to be between the ages of 17 and 24; a high school education or its equivalent is desirable. Good physical condition and manual dexterity are important assets. Many apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program generally consists of from 6,000 to 8,000 hours of on-the-job training plus related instruction. During the apprenticeship period the apprentice learns how to use and handle the tools and materials of the trade. The apprentice also learns the relationship between bricklaying and other building trades. He receives related classroom instruction in reading blueprints, layout work, and making measure-

ments and sketches. An illustration of a 3-year apprenticeship work schedule for bricklayers follows:

Type of work	Approximate hours
Total	6,000
Laying of brick	3,000
Mixing mortar, cement and patent mortar; spreading mortar; bonding and tying.	
Building footings and foundations.	
Plain exterior brickwork (straight wall work, backing up brickwork).	
Building arches, groins, columns, piers, and corners.	
Planning and building chimneys, fireplaces and flues, and floors and stairs.	
Laying of stone	600
Cutting and setting of rubblework or stonework.	
Setting of cut-stone trimmings.	
Butting ashlar.	
Pointing, cleaning, and caulking	200
Pointing brick and stone; cutting and raking joints.	
Cleaning stone, brick, and tile (water, acid, sandblast).	
Caulking stone, brick, and glass block.	
Laying of building units	1,700
Terra cotta and tile block cutting and setting.	
Cutting, setting, and pointing of cement blocks, artificial stone, glass blocks, and cork.	
Blockarching.	
Fireproofing	300
Building party walls (partition tile, gypsum blocks, glazed tile, terra cotta).	
Standardized firebrick.	
Specialties.	
Care and use of tools and equipment	200
Trowels, brickhammer, plumb rule, scaffolds, cutting saws, etc.	

A bricklayer has to have an eye for straight lines and proportions, and a knack for using his hands. Since the other building craftsmen must usually fit their work to his, he should know how the parts of a structure fit together. A fair degree of physical endurance is necessary for handling moderately heavy materials hour after hour.

Hourly wage rates for bricklayer apprentices start at 50 percent of the journeyman rate and increase periodically until 95 percent of the journeyman's rate is reached during the last period of the apprenticeship. If apprentice applicants have had training or experience directly related to the trade as, for example, in the Armed Forces or in a trade school, they may be given advanced standing.

In some areas, formal apprenticeship programs for bricklayers include brief, preliminary training at a vocational school or at another type of pre-job training which is designed to give the apprentice sufficient skill in the handling of tools and materials to make him productive at the start of his on-the-job training.

Bricklayers may advance to jobs as foremen. They may also become estimators for a bricklaying contractor where their jobs consist of computing material requirements and labor costs. A small number advance to the position of bricklaying superintendent on large construction projects, while others start their own bricklaying contracting business. Adequate financial resources and a sound knowledge of business principles and practices, in addition to a knowledge of the trade, are basic requirements for success as a contractor.

Employment Outlook

Continued rapid increase in the employment of bricklayers is expected in the late 1950's and the 1960's. Replacement needs will also provide many job opportunities for new workers.

Bricklaying has been one of the fastest growing building trades. Employment in this trade increased from about 105,000 in 1940 to 165,000 in 1950, and to about 200,000 in mid-1956. It is expected to grow faster than most of the other building trades and much faster than the Nation's total labor force during the 1956–66 decade. Much of the growth will result from the anticipated sharp rise in new building construction activity. (See discussion, p. 229). Moreover, expected higher levels of personal income will increase the demand for higher priced homes; in general, a larger proportion of higher priced homes are made with brick. Also, increasing use of structural clay tile for fire-resistant partitions and glass blocks for exterior walls is expected.

Employment of bricklayers is expected to rise substantially despite a continuation of some technological construction developments which reduce the amount of brick used per structure. For example, the introduction of steel-frame and reinforced concrete structures has permitted the elimination of load-bearing exterior walls in buildings and the substitution of light metal panels. The use of large glass wall panels in many buildings is resulting in less masonry work. Also, ornamental brick work is being less widely used in building decoration.

In addition to job openings that will result from the expected growth of employment in this trade, the need to replace experienced bricklayers who die, retire, or leave the trade for other reasons will provide many job opportunities for new workers. Deaths and retirements alone will result in about 4,000 job openings annually in the 1956–66 decade.

Earnings and Working Conditions

Bricklayers generally receive the highest hourly wage rates among skilled building craftsmen. However, because the nature of their work is highly seasonal, more so than for most of the other skilled building trades, the average annual earnings of bricklayers are less than those for many other building trades.

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for bricklayers in the 52 large cities surveyed was $3.62, compared with $3.22 for all journeymen in the building trades. (Wage rates for this trade may vary within the same city depending upon the type of work performed and the working conditions.) Among the individual cities the minimum union hourly wage rates ranged from $3 in Charlotte, N. C., to $4.05 in New York, as shown in the following tabulation:

Atlanta, Ga	$3.35
Baltimore, Md	3.45
Birmingham, Ala	3.50
Boston, Mass	3.50
Buffalo, N. Y	3.49
Charlotte, N. C	3.00
Chicago, Ill	3.63
Cincinnati, Ohio	3.60
Cleveland, Ohio	3.55
Columbus, Ohio	3.50
Dallas, Tex	3.70
Dayton, Ohio	3.60
Denver, Colo	3.63
Des Moines, Iowa	3.65
Detroit, Mich	3.63
Erie, Pa	3.45
Grand Rapids, Mich	3.45
Houston, Tex	3.69
Indianapolis, Ind	3.63
Jacksonville, Fla	3.10
Kansas City, Mo	3.70
Knoxville, Tenn	3.35
Little Rock, Ark	3.40
Los Angeles, Calif	3.80
Louisville, Ky	3.58
Memphis, Tenn	$3.75
Milwaukee, Wis	3.40
Minneapolis–St. Paul, Minn	3.43
Newark, N. J	4.00
New Haven, Conn	3.25
New Orleans, La	3.25
New York, N. Y	4.05
Oklahoma City, Okla	3.50
Omaha, Nebr	3.38
Peoria, Ill	3.55
Philadelphia, Pa	3.75
Pittsburgh, Pa	3.60
Portland, Oreg	3.50
Providence, R. I	3.33
Richmond, Va	3.25
Rochester, N. Y	3.51
St. Louis, Mo	3.75
Salt Lake City, Utah	3.25
San Antonio, Tex	3.38
San Francisco–Oakland, Calif	3.75
Scranton, Pa	3.38
Seattle, Wash	3.55
Spokane, Wash	3.55
Springfield, Mass	3.28
Syracuse, N. Y	3.43
Toledo, Ohio	3.51
Washington, D. C	3.50–3.65

A large proportion of bricklayers are members of the Bricklayers, Masons and Plasterers International Union of America. Union-employer contracts covering bricklayers usually provide health insurance and pension benefits either financed entirely by the employers or jointly by the workers and employers.

The work of the bricklayer is active and sometimes even strenuous, like the work in other building trades. It frequently involves stooping to pick up materials, moderately heavy lifting, and prolonged standing. Most of the work is done outdoors.

Where To Go for More Information

A young man who wishes to obtain further information regarding bricklaying apprenticeships or work opportunities in the trade should apply to a bricklaying contractor in his area, a local of the Bricklayers, Masons and Plasterers International Union of America, or the local, joint employer-union apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities. Some local employment service offices provide such services as screening applicants and giving aptitude tests.

Additional information may be obtained from:

Associated General Contractors of America, Inc.,
Munsey Bldg., NW., Washington 4, D. C.

Bricklayers, Masons and Plasters International Union of America,
815 15th St., NW., Washington 5, D. C.

Structural Clay Products Institute,
1520 18th St., NW., Washington 6, D. C.

National Association of Home Builders,
1625 L St., NW., Washington 6, D. C.

Electricians (Construction)

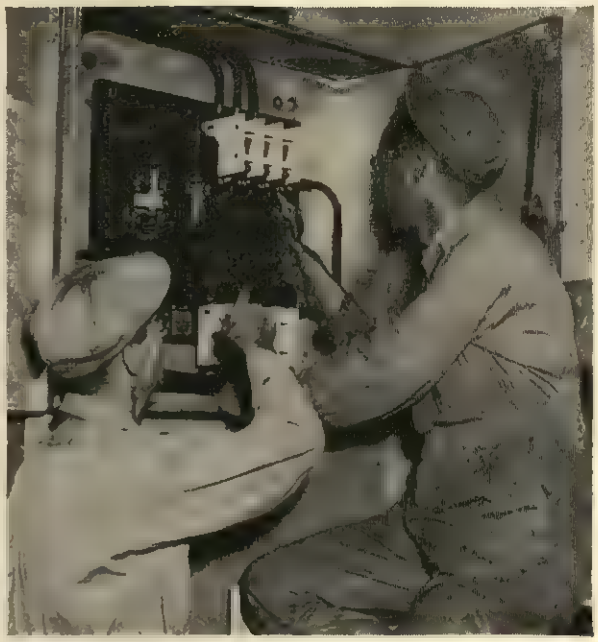
(D. O. T. 4–97.010)

Nature of Work

Construction electricians perform the various tasks related to electrical work on construction projects. They lay out, assemble, install, and test electrical fixtures, apparatus, and wiring used in the heating, lighting, power, air conditioning, refrigeration and other electrical systems of residences, office buildings, factories, hospitals, schools, and other structures. They also connect electrical machinery, equipment, and controls. (Maintenance electricians do work which is similar in many respects to that performed by construction electricians. A discussion of maintenance electricians is presented later. See index.)

Following blueprints or other instructions, construction electricians install many types of switches, conduits, controls, insulation, circuit breakers, wires, and other electrical components. If there is no electrical drawing, showing which outlets are to be on each circuit, the electrician arranges them according to local codes and regulations so that the loads will be properly adjusted and no circuit will have a heavier load than is permissible for the current-carrying capacity of the conductor used. The electrician must know and follow the electrical codes (regulations of individual States and municipalities).

When doing electrical work, the construction electrician may have to bend a conduit (tubing) through which the electrical wires are pulled and connect the wires to switchboxes or other electrical outlets. He splices wires, that is, after removing some of the insulation and scraping the exposed wires he then twists the wires around each other to form a connection which is then soldered and sealed with electrical tape. He also makes connections by the use of "wire-nuts"—mechanical wire connectors that do not need solder or tape to form an electrical connection. When these operations are completed the electrical circuit is tested with an ohmmeter to determine whether the system is properly grounded or whether the insulation is in good condition, and no circuits are overloaded. Generally, only small tools such as power drills, pliers, wire cutters, screwdrivers, hammers, and light wrenches are necessary to install electrical outlets and fixtures.



Electrician apprentice making wire connections under direction of journeyman electrician.

Electrical work in installations with unusually high electrical power requirements, such as are needed at power plants, steel mills and other establishments, may be done by journeymen (skilled) electricians who specialize in this type of work. However most construction electricians are capable of doing all types of electrical work.

Where Employed

Most construction electricians work for electrical contractors. However, substantial numbers are self-employed and others work for government agencies or business establishments which do their own construction electrical work rather than hire electrical contractors. Although many con-

struction electricians work for the same electrical contractor for several years, job transfers are fairly common so that during a single year a construction electrician may work for an electrical contractor in the construction of new homes or office buildings, or for a manufacturing firm in remodeling its plant or offices.

Employment of these workers is distributed geographically in much the same pattern as the Nation's population. Thus, employment is concentrated in the highly industrialized and populated areas.

Training, Other Qualifications, and Advancement

Completion of a 4- or 5-year apprenticeship program for construction electricians is recommended by training authorities generally as the best way to learn all the aspects of this trade. Some construction electricians, however, have learned the trade informally. They have picked up the trade or one aspect of the trade by working for several years as helpers, observing or being taught by experienced craftsmen. Many of these persons have gained some knowledge of the trade by taking trade school or correspondence courses.

Apprenticeship applicants are generally required to be between the ages of 18 and 24; a high school education or its equivalent, including courses in mathematics and physics, is desirable. Applicants are often required to take tests to determine their aptitude for the trade.

Most apprenticeship programs are conducted under written agreements between the apprentice and local, joint union-employer committees which also supervise the training. (Sometimes the agreement is between the apprentice and the employer or an employer group.) The local, joint apprenticeship committee determines the need for apprentices in the locality and establishes minimum apprenticeship standards and pay and, if necessary, schedules a rotating work program. This program is designed to give the apprentice diversified training by having him work for several electrical contractors. Under formal programs, the apprentice is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training.

The International Brotherhood of Electrical Workers and the National Electrical Contractors have jointly developed an extensive apprenticeship program. They have a national director of apprenticeship who assists the local unions and chapters in this industry.

The apprenticeship program usually requires 8,000 or 10,000 hours of on-the-job training plus related instruction. During the apprenticeship period, the apprentice learns how to use and handle the tools and materials of the trade. He also receives related classroom instruction in such subjects as drafting and electrical layout, mathematics, and electrical theory. An illustration of a 4-year apprenticeship work schedule for construction electricians follows:

Type of work	*Approximate hours*
Total	8,000
Residential installations	1,200
Rigid conduit and EMT (thin wall)	
Flexible conduit and cable	
Connecting and testing	
Service and distribution	
Signal systems	
Residential maintenance and repair	800
Adding additional circuits	
Trouble shooting	
Signal systems	
Commercial installations	2,000
Exposed rigid conduit and EMT	
Concealed rigid conduit and EMT	
Surface raceways	
Wires and cables	
Wiring devices, fixtures, panelboards, etc.	
Industrial installations	1,500
Flexible conduits and cables	
Rigid conduit and EMT	
Duct work	
Industrial installation and connection	1,000
Conductors	
Distribution panels	
Switchboards	
Maintenance and repair—Industrial and commercial	500
Specialized work	1,000
Temperature and refrigeration controls	
Specialized fixtures and welding	
Automatic controls	
Signal systems	
Grounding	

Hourly wage rates of apprentices often start at about 50 percent of the journeyman rate and increase by 5 percent in each 6-month period until 85 or 90 percent of the journeyman rate is reached during the last period of the apprenticeship.

An experienced construction electrician who has learned all the aspects of the craft through apprenticeship can transfer readily to other types of electrical work. For example, many take jobs as maintenance electricians in factories or in commercial establishments and others work as electricians in shipbuilding and aircraft manufacturing.

Because improperly installed electrical work is so hazardous, many localities require electricians to be licensed. To obtain a license, the electrician must pass an examination which requires a thorough knowledge of the craft, and of State and local building codes.

Some journeymen electricians may become foremen for an electrical contractor on a particular construction job. They also may become estimators for an electrical contractor computing material requirements and labor costs.

Many journeymen construction electricians go into business for themselves. As they expand their activities they may employ other workers and become contractors. Success as an electrical contractor, however, requires adequate financial resources and a sound knowledge of business principles and practices. In most large urban areas a master (journeyman) electrician's license is required in order to engage in an electrical contracting business.

Employment Outlook

A substantial increase in the number of construction electricians is expected in the 1956–66 decade. Employment in this trade is expected to rise more rapidly than in most of the other building trades. In addition to job openings arising from the growth of the trade, many other job opportunities for new workers will be created by the need to replace experienced electricians who die, retire, transfer to other types of electrical work, or leave the field for other reasons. This is a large occupation—about 125,000 construction electricians were employed in mid-1956—and deaths and retirements alone will result in about 2,500 job openings annually during the 1956–66 decade.

Employment of construction electricians doubled between 1940 and 1956. Continued growth in this occupation is expected as a result of the anticipated large expansion in construction activity during the 1956–66 decade (see discussion, p. 229). Moreover, the increasing use of electrical appliances and devices in homes, factories, and commercial buildings will create more work for these skilled craftsmen.

Earnings and Working Conditions

Hourly wage rates of construction electricians are among the highest in the skilled building trades. Furthermore, because the seasonal nature of construction work affects electricians to a lesser extent than most other construction workers, their annual earnings are generally among the highest in the building trades.

The Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that as of July 1, 1956, the average union hourly rate for electricians in the 52 large cities surveyed was $3.34, compared with $3.22 for all journeymen in the building trades. Among the individual cities the minimum union hourly wage rates ranged from $2.70 in Charlotte, N. C., to $4 in Newark, as shown in the following tabulation (wage rates for this trade may vary within the same city depending upon the type of work performed and the working conditions):

Atlanta, Ga	$3.10
Baltimore, Md	3.30
Birmingham, Ala	3.18
Boston, Mass	3.20
Buffalo, N. Y	3.50
Charlotte, N. C	2.70
Chicago, Ill	3.48
Cincinnati, Ohio	3.50
Cleveland, Ohio	3.60
Columbus, Ohio	3.28
Dallas, Tex	3.13
Dayton, Ohio	3.46
Denver, Colo	3.00
Des Moines, Iowa	3.20
Detroit, Mich	3.50
Erie, Pa	3.25
Grand Rapids, Mich	3.20
Houston, Tex	3.25
Indianapolis, Ind	3.35
Jacksonville, Fla	3.20
Kansas City, Mo	3.20
Knoxville, Tenn	3.00
Little Rock, Ark	2.88
Los Angeles, Calif	3.60
Louisville, Ky	3.30
Memphis, Tenn	3.00
Milwaukee, Wis	3.05
Minneapolis–St. Paul, Minn	3.12
Newark, N. J	4.00
New Haven, Conn	3.25
New Orleans, La	3.03
New York, N. Y	3.50

Oklahoma City, Okla	$3.25
Omaha, Nebr	3.25
Peoria, Ill	3.30
Philadelphia, Pa	3.25–3.78
Pittsburgh, Pa	3.50
Portland, Oreg	3.10
Providence, R. I	3.00
Richmond, Va	2.85
Rochester, N. Y	3.37
St. Louis, Mo	3.50
Salt Lake City, Utah	3.00
San Antonio, Tex	3.13
San Francisco–Oakland, Calif	3.30–3.38
Scranton, Pa	3.10
Seattle, Wash	3.10
Spokane, Wash	3.20
Springfield, Mass	3.05
Syracuse, N. Y	3.50
Toledo, Ohio	3.25–3.40
Washington, D. C	3.50

A large proportion of construction electricians are members of the International Brotherhood of Electrical Workers. Some are members of other unions. Union-employer contracts covering construction electricians usually provide health insurance and pension benefits, either financed entirely by employers, or jointly by the workers and employers. The union also operates its own pension program.

The work of the construction electrician, like that of other building trades, is active but does not require great physical strength. He frequently stands for prolonged periods; sometimes he must squat or work in cramped quarters. Because most of their work is indoors the construction electrician is less exposed to unfavorable weather conditions than most other skilled building trades workers. Electricians risk the danger of falls from ladders, cuts from sharp tools, electrical shock, and burns from "live" wires. However, safety practices learned during apprenticeship and other types of training have helped to reduce the injury rate for these workers. The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of work injuries shows that in 1955 the injury frequency rate for employees in contract electrical work was less than that for contract construction work as a whole, but higher than that for production workers in manufacturing industries.

Where To Go for More Information

A young man who wishes to obtain further information regarding electrician apprenticeships or work opportunities in the trade should apply to one of the electrical contractors in his area, or a local of the International Brotherhood of Electrical Workers, or a local union-employer apprenticeship committee if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities. Some local employment service offices provide such services as screening applicants and giving aptitude tests.

Additional information may be obtained from:

Director of Apprenticeship, National Joint Apprenticeship and Training Committee for the Electrical Industry,
1200 18th St., NW., Washington 6, D. C.

National Association of Home Builders,
1625 L St., NW., Washington 6, D. C.

For information on the employment outlook for the various electrical fields see:

Employment Outlook in Skilled Electrical and Electronic Occupations VA Pamphlet 7–9.
For sale by the Superintendent of Documents,
U. S. Government Printing Office,
Washington 25, D. C. Price 40 cents.

Structural, Ornamental, and Reinforcing-Iron Workers

(D. O. T. 4–84.010, .020, .030, .040, .060, 7–32.251)

Nature of Work

Structural- and ornamental-iron workers and rodmen (reinforcing-iron workers) erect, assemble, or install fabricated structural metal products in the construction of industrial, commercial, and large residential buildings. Although these are distinct trades, many craftsmen are skilled in, and do the work of, two or all three of the trades.

Structural-iron workers erect the steel framework of bridges, buildings, and other structures including metal storage tanks, and overhead crane runways that support heavy equipment. They install steel floor decking and vault doors and their frames. They also erect steel scaffolding for use by other construction craftsmen and sidewalk canopies for the protection of the public during the building or repairing of structures.

COURTESY OF U. S. ATOMIC ENERGY COMMISSION

Ironworkers install steel reinforcement in preparation for concrete pouring.

In erecting a steel framework or structure, structural-iron workers take the steel shapes already fabricated in shops by other workers and hoist them into place in the proper order. Next, they temporarily connect all the steel shapes with bolts, accurately aline the structure, and rivet or weld the parts. In the construction of a large building, workers generally do not perform all of these operations. Instead, separate gangs perform a particular operation such as riveting.

Ornamental-iron workers install metal stairways, catwalks, floor gratings, and iron ladders such as those used extensively in powerhouse and chemical plants, as well as metal window sash and doors, grilles and screens like those used in bank tellers' compartments and elevators, metal cabinets, and safety deposit boxes. They also install decorative ironwork on balconies, lamp posts, gates, and fences. Ornamental-iron workers generally do not handle the basic structural steel shapes which are put in place by the structural-iron workers.

In addition to iron and steel, ornamental-iron workers work with aluminum alloy, brass, and bronze metal shapes. The metal shapes which they install have been fabricated in a factory or a shop. They fasten these metal products permanently to a building or other structure by bolting, setting in concrete, or welding.

Reinforcing-iron workers (*rodmen*) set steel bars in concrete forms to reinforce the concrete structures. They place the steel bars on suitable supports in the concrete form and tie the bars together at intersections, so that each bar receives its intended structural load. The bars are placed in the concrete form according to blueprints, specifications, or verbal instructions. The rodmen use steel pliers and other tying tools to wire the rods securely in place. Some concrete reinforcing is in the form of coarse mesh made of heavy steel wires. When using mesh, the rodmen measure the surface to be covered, cut and bend the mesh to the desired shape, place the mesh over the area to be reinforced, and hammer it into place.

Where Employed

Structural-, ornamental-, and reinforcing-iron workers (rodmen) are employed primarily on new industrial and commercial construction. They also do some alteration work. For example, they may install steel stairs in an old apartment or commercial building or they may add window guards to an existing building for burglary protection. These workers also do a small amount of repair work, such as replacement of a metal bridge part. Some highly skilled structural steel workers are able to transfer to jobs in structural steel fabricating shops.

A large proportion of these craftmen are employed by general contractors, on large building projects or by steel erection contractors or ornamental-iron contractors. Many are employed by large steel companies or their subsidiaries engaged in the construction of bridges, dams, and large buildings. Some work for government agencies, public utilities, or large industrial establishments which do their own construction work. Few of these craftsmen are self-employed.

Structural- and ornamental-iron workers and rodmen are employed throughout the country. However, a large proportion of their jobs are in the highly populated and industrial centers where large commercial and industrial structures are constructed.

Training and Other Qualifications

Completion of a 2-year apprenticeship is recommended by training authorities generally as the best way to learn these trades. A few workers with

several years' experience as helpers have become journeymen, but it has been more difficult to achieve journeyman status in this manner in recent years.

Apprenticeship applicants are generally required to be between the ages of 17 and 30. Good physical condition is required. A high school education or its equivalent is desirable. Apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Under formal programs the apprentice is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program for these trades usually consists of 4,000 hours of on-the-job training plus related instruction. The apprentice learns how to use and handle the tools, machines, and materials of the trade. On-the-job instruction is given either by the foreman or an experienced journeyman. The apprenticeship program generally includes a minimum of 144 hours a year of related instruction in such subjects as drafting and blueprint reading, mathematics applicable to layout work, and the use, care, and maintenance of machines and equipment used in the trade. Areawide apprenticeship programs, sometimes covering an entire State or region, are found extensively in this trade. They are supervised by apprenticeship committees composed of representatives of the Iron Workers' local union and the local employer group. An illustration of a combined structural- and ornamental-iron workers apprenticeship work program follows:

- Proper care and use of tools, equipment, and materials.
- Reading blueprints and working drawings.
- Forming, shaping, drilling, tapping, and erecting and assembling iron, brass, bronze, aluminum, and other metals.
- Laying out and assembling steel stairs, fire escapes, grilles, railing, fences, doors, and related metal equipment, and vaults.
- Arc and gas welding and gas cutting.
- Repairing and altering.
- Erecting steel buildings, bridges, and other structures.
- Unloading, handling, and erecting of hoisting equipment.
- Bolting, riveting, plumbing, and welding of steel and other metals.
- Rigging of all types including gin poles, guy derricks, stiffleg derricks, and all power cranes and winches.
- Moving machinery by using rollers, jacking, cribbing, and other methods and equipment.

Hourly wage rates for apprentices start at 50 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of the apprenticeship. In some localities, the starting rate may be as high as 75 percent of the journeyman rate. If apprenticeship applicants have had experience directly related to the trade as, for example, training in ironwork in a factory or in the Armed Forces, they may be granted advanced apprenticeship standing.

Employment Outlook

A substantial increase in the employment of these workers is expected during the late 1950's and the 1960's. In addition to job openings resulting from the growth of employment in these occupations, the need to replace experienced workers who die, retire, or leave the trade for other reasons will create several thousand job opportunities for new workers each year. Deaths and retirements alone will create about 1,500 to 2,000 job openings annually.

In recent years, these trades had been among the fastest growing of the skilled building trades. Employment of structural- and ornamental-iron workers and rodmen about tripled between 1940 and 1956. Continued rapid rise in employment of these workers is expected during the 1956–66 decade, principally because of the anticipated expansion in the level of construction activity. (See discussion, p. 229.) The job outlook in these trades will also be favorably affected by the increased use of structural steel in smaller buildings.

Earnings and Working Conditions

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for structural-iron workers in the 52 large cities surveyed was \$3.30, and \$3.17 for rodmen, compared with \$3.22 for all journeymen in the building trades. Among the individual cities the minimum union hourly wage rates ranged from \$2.75 in Charlotte, N. C., to \$4.15 in Newark and New York for structural-iron workers and from \$2.50 in Charlotte, N. C., to \$4.15 in Newark for rodmen, as shown in the following tabulation:

	Rodmen	Structural-iron workers
Atlanta, Ga	$2.80	$3.05
Baltimore, Md	3.25	3.50
Birmingham, Ala	2.75	3.00
Boston, Mass	3.55	3.55
Buffalo, N. Y	3.32	3.32
Charlotte, N. C	2.50	2.75
Chicago, Ill	3.55	3.55
Cincinnati, Ohio	3.19	3.35
Cleveland, Ohio	3.50	3.50
Columbus, Ohio	3.20	3.20
Dallas, Tex	2.80	3.08
Dayton, Ohio	3.16	3.28
Denver, Colo	3.00	3.00
Des Moines, Iowa	3.05	3.05
Detroit, Mich	3.22	3.53
Erie, Pa	3.48	3.48
Grand Rapids, Mich	3.15	3.39
Houston, Tex	2.75	3.00
Indianapolis, Ind	3.28	3.28
Jacksonville, Fla	2.55	2.81
Kansas City, Mo	2.93	3.08
Knoxville, Tenn	2.89	2.99
Little Rock, Ark	2.70	2.85
Los Angeles, Calif	3.00	3.25
Louisville, Ky	3.18	3.18
Memphis, Tenn	2.63	2.78
Milwaukee, Wis	3.17	3.17
Minneapolis–St. Paul, Minn	3.07	3.17
Newark, N. J	4.15	4.15
New Haven, Conn	3.55	3.55
New Orleans, La	2.70	3.00
New York, N. Y	3.75	4.15
Oklahoma City, Okla	2.95	2.95
Omaha, Nebr	3.00	3.00
Peoria, Ill	3.43	3.43
Philadelphia, Pa	3.55	3.70
Pittsburgh, Pa	3.30	3.30
Portland, Oreg	2.87	3.07
Providence, R. I	3.45	3.45
Richmond, Va	2.58	2.83
Rochester, N. Y	3.35	3.35
St. Louis, Mo	3.25	3.25
Salt Lake City, Utah	3.00	3.00
San Antonio, Tex	2.75	3.00
San Francisco–Oakland, Calif	3.00	3.25
Scranton, Pa	3.70	3.80
Seattle, Wash	2.87	3.07
Spokane, Wash	2.87	3.07
Springfield, Mass	3.53	3.53
Syracuse, N. Y	3.30	3.30
Toledo, Ohio	3.30	3.40
Washington, D. C	3.40	3.65

The earnings of ironworkers are often augmented by considerable overtime work at premium pay. As with other building trades in which much of the work is done outdoors, these craftsmen lose much working time because of weather and other reasons. Rodmen, in particular, are intermittently out of work because each of their jobs lasts only a few days or weeks.

A large proportion of workers in these trades are members of the International Association of Bridge, Structural, and Ornamental Iron Workers. Many union-employer contracts covering these trades provide health insurance and pension benefits financed entirely by the employers.

Since the materials used in the structural metal trades are heavy and bulky, above average physical strength and agility are necessary. A good sense of balance is also required because some of the structural work is done at great heights and on narrow footings. Structural-iron work often involves considerable travel. In most localities, the demand for structural-iron work is insufficient to keep a large structural-steel contractor or local crews constantly employed. Consequently, workers must be brought in from outside the area to handle the occasional large construction projects, such as a steel frame office or factory building. Large contractors may keep a nucleus of their structural-iron worker crew continually employed, moving them from job to job and city to city.

The use of many safety devices, such as nets and scaffolding, has reduced accident frequency in recent years. Nevertheless, the injury rate in contract structural- and ornamental-iron work is higher than for contract construction work as a whole.

Where To Go for More Information

A young man who wishes to obtain further information concerning apprenticeships or work opportunities in these trades should apply to the large general contractors in his area or to a local of the International Association of Bridge, Structural, and Ornamental Iron Workers. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Associated General Contractors of America, Inc., Munsey Bldg., NW., Washington 4, D. C.

International Association of Bridge, Structural and Ornamental Iron Workers, Continental Bldg., Suite 300, 3615 Olive St., St. Louis 8, Mo.

Sheet Metal Workers

(D. O. T. 4-80.010)

Nature of Work

Sheet metal workers fabricate and install ducts which are used in ventilating, air-conditioning, and heating systems. They also fabricate and install a wide variety of other products made from thin metal sheets, such as roofing and siding, commercial stainless steel kitchen equipment, partitions, sheet metal shelves in industrial establishments, store fronts, metal frame work for neon signs, and materials chutes.

In heating or air-conditioning duct work, the sheet metal worker lays out and plans the job, determining the size and type of sheet metal to be used. The ducts are often fabricated at the sheet metal shop. In fabricating work, sheet metal workers cut the metal with hand snips, power-driven shears, power brakes, or other types of cutting tools. They form the metal with bending machines, hammers, and anvils, then weld, bolt, rivet, solder, or cement the seams and joints. However, prefabricated ducts in standard sizes are often available and these require little fabrication at the shop. Some duct fabrication is done at the work site in the installation process, especially on large sheet metal jobs. In the installation, the component parts are fitted together and assembled. Hangers and braces are installed to support ducts, and joints may be soldered. Some journeymen workers specialize in shop work or on-site installation work. However, it is essential that skilled workers know all aspects of the trade.

Where Employed

Sheet metal workers are employed mainly by heating, refrigeration, and air-conditioning contractors engaged in residential, industrial, and commercial building work. In residential construction, these workers may also work for roofing contractors who specialize in metal roofing.

In addition, many of these craftsmen work for government agencies or business establishments which do their own construction and alteration work. Others are self-employed, mainly on repair work or on smaller types of installations. Some craftsmen are employed in small shops manufacturing specialty products, such as custom kitchen equipment for hotels and restaurants.

Apprentice observing sheet metal worker weld duct before installation.

Many skilled sheet metal workers are also employed by railroad, aircraft, or shipbuilding companies. Firms making blowers, exhausts, electrical generating and distributing equipment, food products machinery, steam engines, and turbines also employ skilled sheet metal workers. Skilled sheet metal workers should not be confused with assembly line factory operatives who also make sheet metal products but are trained in only a few specific operations.

In mid-1956, the jobs of the skilled sheet metal workers were distributed throughout the country in about the same pattern as those of building trades workers generally (see p. 227), with concentrations in California, New York, Pennsylvania, Illinois, and Ohio.

Training, Other Qualifications, and Advancement

Most training authorities recommend the completion of a 4- or 5-year apprenticeship program as the best way to learn this trade. Some sheet metal workers, however, have learned the trade

informally. They have picked up the trade by working for several years as helpers or handymen, observing or being taught by experienced craftsmen. Many of these persons have gained some knowledge of the trade by taking correspondence or trade school courses.

Apprentice applicants are generally required to be between the ages of 17 and 21; a high school education or its equivalent is desirable. Good physical condition and mechanical aptitude are necessary assets. Many apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State or apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program usually consists of 8,000 to 10,000 hours of on-the-job training, plus related classroom instruction. During the apprenticeship period the apprentice learns how to use and handle the tools, machines, and materials of the trade. The trainee also learns the relationship between sheet metal work and other building trades. He also receives related classroom instruction in such subjects as drafting, blueprint reading, and mathematics applicable to layout work. An illustration of an apprenticeship training program for sheet metal workers follows:

General shop work
- Tools, machines, and equipment:
  - The operation, adjustment, and care of hand tools, bench stakes, and foot and electric power machines and equipment.
- Soldering process:
  - Soldering furnaces and their use, forging and tinning soldering coppers, fluxes and their application, dipping solution and its use, soldering black and galvanized iron and steel, tin, copper, brass, stainless steel, lead, zinc, and other metals.
- General work processes:
  - Transferring patterns to metal and duplicating; cutting materials; forming, folding, grooving, bending, burring and turning edges, wiring edges, riveting, peening, and double-seaming; crimping, flanging, and stretching metal; punching and drilling holes; bumping and shrinking metal; welding and brazing; working strap and angle iron; and using taps and dies.

Residential—outside jobbing
- Roofing, gutters, downspouts, leader heads, flashing, valleys, louvers, ventilators, hoods, overflow outlets.

Architectural and industrial sheet work
- Cornices, skylights, concrete forms, safety guards, fire doors, metal windows, electric signs, and marquees.

Air-conditioning, heating, and ventilating
- Ducts, pipes, elbows, transitions, offsets, branches, taps, tees, dampers, fan connections, and foundations.

Exhaust-blow piping and refuse collection
- Pipes, elbows, branches, hoods, hoppers, and duct separators.

Warm air furnace and heating equipment
- Pipes, elbows, boots, register boxes, grilles, cold air returns, roughing in, and setting furnaces.

Hotel, restaurant, fountain, and bar equipment
- Sinks, scrap tables, steam tables, trays, canopies, and dishwashers.

Hourly wage rates for sheet metal apprentices start at about 40 percent of the journeyman rate and increase periodically until 90 percent of the journeyman rate is reached during the final portion of the apprenticeship training period. If apprenticeship applicants have had training or experience directly related to the trade, for example, as a result of training in sheet metal work in a vocational school or experience in a factory or in the Armed Forces, they may be granted advanced apprenticeship standing.

Experienced sheet metal workers have more job mobility than many other building trades workers because they can transfer their skills from the construction industry to the metal manufacturing industries. Also they may advance to the position of foreman for a contractor, become superintendents of large projects, or enter business for themselves as sheet metal contractors. Adequate financial resources and a sound knowledge of business principles and practices are usually basic requirements for success as a contractor.

Employment Outlook

There will be a few thousand new job opportunities for young men in this skilled occupation each year during the late 1950's and 1960's. Increased employment of sheet metal workers is expected primarily as a result of the anticipated large expansion in new residential, commercial, and industrial construction in the next decade. (See discussion, p. 229.) Moreover, the expected large increase in the number of permanently installed air-conditioning systems in residential, commercial, and factory buildings, will provide more work for sheet metal workers. In addition, the manufacturing industries which employ skilled sheet metal workers have generally favorable long-range prospects. The shops which fab-

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ricate sheet metal products used in construction are also expected to require more skilled sheet metal craftsmen in the next 10 years.

Prefabrication is not likely to affect the growth of employment in this occupation as much as most other building trades, because of the custom nature of much of the work. The prefabrication of ducts and fittings for ventilating installations is limited by the need to tailor these installations to meet a wide variety of structural conditions, such as the dimensions of the building and the space allowed for ducts, and the cost of storage space needed to store prefabricated ducts and fittings.

Earnings and Working Conditions

The annual earnings for sheet metal workers tend to be higher than for most other skilled building trades workers because the trade is less affected by seasonal factors and because of higher hourly rates.

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for sheet metal workers in the 52 large cities surveyed was $3.20. (Wages rates for this trade may vary within the same city depending upon the type of work performed and the working conditions.) Among the individual cities, the minimum union hourly wage rates ranged from $2.50 in Charlotte, N. C., to $3.75 in New York, as shown in the following tabulation:

Atlanta, Ga	$3.00
Baltimore, Md	3.20
Birmingham, Ala	2.85
Boston, Mass	3.10
Buffalo, N. Y	3.38
Charlotte, N. C	2.50
Chicago, Ill	3.28
Cincinnati, Ohio	3.33
Cleveland, Ohio	3.50
Columbus, Ohio	3.08
Dallas, Tex	3.10
Dayton, Ohio	3.10
Denver, Colo	3.10
Des Moines, Iowa	3.00
Detroit, Mich	3.25–3.35
Erie, Pa	3.10
Grand Rapids, Mich	2.91
Houston, Tex	3.13
Indianapolis, Ind	3.24
Jacksonville, Fla	2.80
Kansas City, Mo	3.20
Knoxville, Tenn	$3.00
Little Rock, Ark	2.60
Los Angeles, Calif	3.24
Louisville, Ky	3.08
Memphis, Tenn	2.88
Milwaukee, Wis	3.05
Minneapolis–St. Paul, Minn	[illegible]00–3.08
Newark, N. J	3.70
New Haven, Conn	3.15
New Orleans, La	2.82
New York, N. Y	3.75
Oklahoma City, Okla	2.95
Omaha, Nebr	2.88
Peoria, Ill	3.35
Philadelphia, Pa	3.44
Pittsburgh, Pa	3.43
Portland, Oreg	3.00
Providence, R. I	2.90
Richmond, Va	2.70
Rochester, N. Y	3.13
St. Louis, Mo	[illegible]5–3.55
Salt Lake City, Utah	2.71
San Antonio, Tex	3.13
San Francisco–Oakland, Calif	3.30
Scranton, Pa	2.90
Seattle, Wash	3.10
Spokane, Wash	3.04
Springfield, Mass	3.05
Syracuse, N. Y	3.10
Toledo, Ohio	3.20
Washington, D. C	3.41

A large proportion of sheet metal workers are members of the Sheet Metal Workers' International Association. Union-employer contracts covering sheet metal workers usually provide health insurance and pension benefits, either financed entirely by the employers or jointly by the workers and employers.

Some of the older sheet metal workers may work primarily in the shops where their experience is valuable in fabricating and layout work. Most sheet metal workers, however, spend considerable time at the construction site where they may work either indoors or outdoors.

When installing gutters, skylights, and cornices they may work high above the ground level. When installing ventilating and air-conditioning systems they may work in awkward and relatively inaccessible places. Sheet metal workers run the risks of cuts and burns from the materials, tools, and equipment used in their trade.

Where To Go for More Information

A young man who wishes to obtain information regarding sheet metal apprenticeships or work

opportunities in this trade should contact sheet metal contractors or heating, refrigeration, or air-conditioning contractors; a local of the Sheet Metal Workers' International Association; or a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Further information may be obtained from:

Sheet Metal Contractors' National Association, 170 Division St., Elgin, Ill.

Sheet Metal Workers' International Association, 642 Transportation Bldg., Washington 6, D. C.

Roofers

(D. O. T. 5–25.220, 7–31.100 through .500, and 7–32.611)

Nature of Work

Roofers' work includes the application of composition roofing; the installation of roofing tile, roofing slate, and other roofing materials; and the waterproofing and dampproofiing of walls and other surfaces of buildings. In applying composition roofing, the roofer first places overlapping strips of asphalt and impregnated felt over the entire surface. He then applies a coating of tar, pitch, or other bituminous material to the new surface. This process is repeated until at least three layers or thickness of felt are in place. Finally, he applies a surfacing of tar, pitch, and gravel to protect the roofing materials from the weather.

The composition roofer also lays other types of commercial composition roofing, such as roll roofing and asphalt shingles. The roofer overlaps the roofing material and then fastens it to the roof base with nails or asphalt cement, and, if necessary, cuts the material to fit corners, pipes, and chimneys. The roofer then cements or nails flashing (strips of metal) wherever two roof surfaces intersect, for example, at chimneys, valleys, gutters, and where the roof meets vertical walls. Flashing is installed to make the intersections (joints) watertight. In another method of applying roofing, the roofer mops a layer of hot asphalt over the entire surface and rakes pebbles over the asphalt.

Roofers also use metal, tile, and slate for the more expensive types of roofs. Metal roofs are constructed by soldering metal sheets together and nailing them to the wood sheathing. In installing tile and slate roofs, the roofer places a covering of roofing felt over the roofing sheathing. He punches holes in the slate or tile, and nails it to the wood sheathing. Each piece of slate or tile is placed so as to overlap the adjoining piece and is nailed into place. Finally, the roofer covers the exposed nailheads with roofing cement to protect them from the weather. Handtools are mainly used in applying roof surfaces—for example, hammers, roofing knives, mops, pincers, and caulking guns.

Roofers also do waterproofing and dampproofing work on parts of structures other than roofs, such as masonry or concrete walls that are in contact with the ground, swimming pools, and other tanks. The roofer prepares surfaces to be waterproofed by removing rough projections and roughing glazed surfaces, using a hammer and chisel. He then applies a coat of liquid compound with a brush. He also paints or sprays the surfaces with a waterproof material or nails waterproofing fabric to the surfaces. In dampproofing work, he usually sprays a coating of tar or asphalt on interior or exterior surfaces to prevent the penetration of moisture.

Where Employed

Roofers work mainly for roofing contractors on new building construction. They also do maintenance and repair work, especially on composition roofing. Some roofers are self-employed, usually on small, new building work or doing repairs and alterations. Roofers also work for government agencies or business establishments which do their own construction and repair work.

The jobs of the approximately 50,000 roofers employed in mid-1956 were found in every State, with concentrations in the highly industrialized and populated States.

Training, Other Qualifications, and Advancement

Completion of a 3-year apprenticeship covering all types of roofing work is generally recommended

by authorities in this field as the superior way to learn this trade. A substantial proportion of roofers, however, have learned the trade informally. They have picked up the trade by working for several years as helpers or handymen, observing or being taught by experienced roofers.

Apprenticeship applicants are generally required to be at least 18 years old; a high school education or its equivalent is desirable. Good physical condition and a good sense of balance are important assets. Many apprenticeship programs are under the supervision of local, joint union-employer apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program generally consists of a minimum of 525 days of on-the-job training, plus related classroom instruction. During the apprenticeship period the apprentice learns how to use and handle tools and materials of the trade. He also receives related classroom instruction in such subjects as blueprint reading and mathematics applicable to layout work. An illustration of a 3-year apprenticeship work program for roofers follows:

General:
- Carrying and placing materials for use of journeymen.
- Erection of scaffolding.
- Hoisting, loading, and unloading all materials and tools.

Composition, tar, asphalt, and general work:
- Preparing materials and equipment and regulating the heat of pitch.
- Preparing roof surface for covering.
- Apply pitch to roof.
- Prepare, cut, place, fit, and trim strips of felt, tar paper, roofing paper or insulating board to roof.
- Apply additional layers of roofing material as required.
- Cement tar paper with hot tar or flashing cement.
- Evenly distribute crushed gravel over top coat of tar.

Promenade tile work:
- Mark out areas to be tiled.
- Prepare surface for tiling.
- Lay and fit tiles with proper spacing.
- Prepare and apply clay mixture to protect tile during application of hot asphalt.
- Pour asphalt into tile spaces and spread grout in same.
- Clean tiles with acid after grout has hardened.

Slate, tile, terra cotta, and substitute materials work:
- Cover roof sheathing with felt.
- Fasten slate in rows (punching nail holes, nailing slate, providing for proper overlap).
- Cut slate to fit ridges, valleys, and edges by perforating, breaking, or trimming slate.
- Seal ridge joints.
- Apply flashing.
- Replacing broken slate or tile.
- Cleaning completed roof.

Other materials:
- Felt, wood, coal, oil, lumber, roofing paper, insulating board, pitch, flashing cement, gravel, and slag.
- Tile blocks, cement mortar, grout, water, dilute acid solution, and asphalt.
- Roofing cement, slate, terra cotta, asbestos roofing shingles, roofing felt, sheet metal flashing, and all other materials awarded to the roofers' jurisdiction.

All types of dampproofing and waterproofing.
- Apply membrane, plastic, pitch, and asphalt.

Hourly wage rates for apprentices start at about 65 percent of the journeyman rate and increase periodically until 90 percent of the journeyman rate is reached in the final 6 months of the training period. If apprentice applicants have had experience directly related to the trade, for example in the Armed Forces, or as a helper, they may be granted advanced apprenticeship standing.

Roofers may advance to the position of foreman for a roofing contractor. Also, they may enter business for themselves. However, adequate financial resources and a sound knowledge of business principles and practices are basic requirements for success as a roofing contractor.

Employment Outlook

There will be a few thousand job opportunities for new workers in this occupation each year in the late 1950's and the 1960's. Most openings will result from the anticipated large expansion in construction activity. (See discussion, p. 229.) In addition, the need to replace workers who die, retire, or transfer to other fields of work will create other job openings. Deaths and retirements alone will create about 1,000 job opportunities each year during the 1956–66 decade.

Application of roofing on new construction and repair will provide most of the work for these building craftsmen. However, dampproofing and

waterproofing are providing an increasing proportion of the roofers' work.

Earnings and Working Conditions

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for roofers in the 52 large cities surveyed was $2.96 for composition roofers and $3.08 for slate and tile roofers. (Wage rates for this trade may vary within the same city depending upon the type of work performed and the working conditions.) Among the individual cities the minimum hourly wage rates ranged from $1.85 in San Antonio to $3.75 in Newark for composition roofers, and from $2.20 in San Antonio to $4 in New York for slate and tile roofers, as shown in the following tabulation:

	Composition	*Slate and tile*
Atlanta, Ga	$2. 00	$2. 25
Baltimore, Md	2. 50–2. 90	2. 90–3. 50
Birmingham, Ala	2. 28	2. 28
Boston, Mass	3. 10	3. 10
Buffalo, N. Y	3. 03	3. 18
Charlotte, N. C	---------	---------
Chicago, Ill	3. 65	3. 65
Cincinnati, Ohio	3. 10	3. 33–3. 43
Cleveland, Ohio	3. 58	3. 58
Columbus, Ohio	3. 00	3. 00–3. 18
Dallas, Tex	2. 35	2. 60
Dayton, Ohio	2. 88	3. 10
Denver, Colo	3. 00	3. 00
Des Moines, Iowa	2. 53	2. 53
Detroit, Mich	3. 36	3. 71
Erie, Pa	2. 65	2. 65
Grand Rapids, Mich	2. 60	2. 85
Houston, Tex	2. 63	3. 13
Indianapolis, Ind	2. 66	2. 91
Jacksonville, Fla	2. 45	2. 45
Kansas City, Mo	2. 80	2. 80
Knoxville, Tenn	2. 23	2. 28
Little Rock, Ark	2. 05	2. 30
Los Angeles, Calif	2. 85	2. 85
Louisville, Ky	2. 45	3. 08
Memphis, Tenn	2. 15	2. 48
Milwaukee, Wis	2. 97–3. 17	3. 12
Minneapolis–St. Paul, Minn	2. 85	2. 85
Newark, N. J	3. 75	3. 65
New Haven, Conn	3. 25	3. 50
New Orleans, La	2. 65	2. 65
New York, N. Y	3. 65	3. 85–4. 00
Oklahoma City, Okla	2. 55	2. 55
Omaha, Nebr	2. 35	2. 60
Peoria, Ill	3. 09	3. 09
Philadelphia, Pa	3. 15	3. 44
Pittsburgh, Pa	$3. 10	$3. 15
Portland, Oreg	3. 00	3. 00
Providence, R. I	2. 70	2. 90
Richmond, Va	---------	---------
Rochester, N. Y	3. 02	3. 02
St. Louis, Mo	3. 20	3. 00
Salt Lake City, Utah	2. 60	2. 60
San Antonio, Tex	1. 85	2. 20
San Francisco–Oakland, Calif	3. 00	3. 00
Scranton, Pa	2. 75	2. 75
Seattle, Wash	2. 90	3. 15
Spokane, Wash	2. 90	3. 18
Springfield, Mass	2. 85	3. 03
Syracuse, N. Y	3. 05	3. 05
Toledo, Ohio	3. 20	3. 20
Washington, D. C	2. 50	3. 00

A large proportion of roofers are members of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association. Union-employer contracts covering roofers usually provide health insurance and pension benefits, either financed entirely by the employers or jointly by the workers and employers.

Roofers' work, like that of other building trades, is active and sometimes strenuous. It involves prolonged standing, as well as climbing, bending, and squatting. These workers risk injuries from slips or falls from scaffolds or roofs. In doing repair work these workers may have to be outdoors in all types of weather.

Where To Go For More Information

A young man who wishes to obtain further information concerning roofing apprenticeships or work opportunities in this trade should apply to roofing contractors in his area; a local of the United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association; or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

National Roofing Contractors Association,
315 West Madison St., Chicago 6, Ill.

United Slate, Tile and Composition Roofers, Damp and Waterproof Workers Association,
6 East Lake St., Chicago 6, Ill.

National Association of Home Builders,
1625 L St., NW., Washington 6, D. C.

Plasterers

(D. O. T. 5–29.100, .200, and .300)

Nature of Work

The principal work of plasterers is the application of several coats of plaster to a suitable base to produce wall and ceiling surfaces. Another important aspect of their work is the finishing of these plaster surfaces. Plasterers use a trowel to spread the plaster on a masonry base or on metal lath or gypsum lath. They then smooth the surface by rubbing it with a darby (a narrow, level board with handles at each end). Two or three coats of plaster are applied to flat surfaces. The first or "scratch" coat consists of plaster containing sand and some animal hair; the surface is roughened because it is used as the base for the second coat. The second or "brown" coat (sometimes the finish coat), containing sand, but no hair, is then applied to build up the thickness and strength of the paster. Sometimes a third or finish coat, usually a thin layer consisting of lime and plaster of paris, is applied and the surface is smoothed and leveled.

In stucco masonry, the plasterer applies a covering of portland cement or gypsum plaster to the walls of a building. The finish coat is then decorated by spattering it with small stones, or a decorative effect is created by using a brush or trowel. Some skilled plasterers specialize in ornamental work, such as moldings and cornices. There are two methods of installing molding and ornamental trim. In one, the plasterer spreads freshly mixed plaster on a table, shapes the plaster by hand, and cuts the trim to size after the plaster has hardened. The trim is then applied to the wall by pressing it into a coat of damp plaster. In the other method, cornices or moldings are shaped directly on walls or ceilings.

Plaster-mixing machines are largely replacing hand mixing techniques. When working with the recently developed lightweight plasters, which contain vermiculite (made from a form of mica) and perlite (made from a volcanic glass), plasterers are making increasing use of plaster guns to spray the plaster on walls. In particular, these lightweight plasters have been used for fireproofing structural steel in large buildings.

Journeymen (skilled) plasterers are usually assisted by apprentices who supply them with materials, set up and move scaffolding, and provide other services needed for performance of the journeyman's work. In many small localities, journeymen plasterers also perform the work of cement finishers.

Where Employed

Most plasterers are employed on new building construction. In addition, plasterers do extensive building alteration work, particularly where special architectural and lighting effects are part of the building modernization. There is a relatively small amount of work for plasterers in the repair and maintenance of older buildings. Jobs for plasterers are found throughout the country. They are distributed in much the same pattern as the Nation's population (see discussion on geographical distribution of building trades jobs on p. 227).

Training, Other Qualifications, and Advancement

Most training authorities recommend a 3- or 4-year apprenticeship as the best way to learn the plastering trade. A substantial proportion of plasterers, however, have learned the skills of this occupation informally. They have picked up the trade by working for several years as helpers or laborers, observing or being taught by experienced plasterers.

Apprentice applicants in this trade are generally required to be between the ages of 18 and 25. Good physical condition and manual dexterity are important assets. Many plasterer apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training. The programs generally consist of 6,000 to 8,000 hours of on-the-job training plus related classroom instruction. During the apprenticeship period, the apprentice learns how to use and handle the tools of the trade. He learns the properties and appropriate handling of the different kinds of materials and mixtures used in plastering. He is taught to lay out curved, arched, vaulted, and other ornamental work, which

may present difficult geometrical problems. The apprentice also becomes familiar with the work of other trades so that he may determine, for example, whether lathing or other preparatory work is satisfactory. Generally, the apprenticeship program includes at least 144 hours of instruction each year in such subjects as drafting, blueprint reading, and mathematics applicable to layout work. An illustration of a 4-year apprenticeship work schedule follows:

Type of work	*Approximate hours*
Total	8,000
First year	2,000
Use of plastering tools and materials; application of scratch coat and brown coat; lining, dotting, and brown coat; lining, dotting, and screeding.	
Second year	2,000
Application of whitecoat and sand finishing; installation of acoustical plaster and stucco.	
Third year	2,000
Texture finishing and installation of acoustical tile, cork, and similar materials; use of browning and finishing machines.	
Fourth year	2,000
Preparation of molds, templates, and cornices; laying out groins, arches, and coffered ceilings.	

Most plasterers remain journeymen throughout their working life, but some may advance to jobs as foremen or estimators. Many plasterers are self-employed. Some self-employed plasterers are able to expand their activities to contracting and hire other journeymen. Adequate financial resources and a sound knowledge of business principles and practices, in addition to a knowledge of the trade, are basic requirements for success as a contractor.

Employment Outlook

A continued moderate increase in the employment of plasterers is expected during the late 1950's and the 1960's. However, employment in this occupation is expected to grow at a slower rate than for the skilled building trades generally. In addition to job openings that will result from expected growth of employment, the need to replace experienced plasterers who die, retire, or transfer to other fields of work will provide many job openings for new workers. Deaths and retirements alone will create about 1,200 to 1,500 job openings annually in the 1956–66 decade.

Continued growth in employment of these workers is expected during the 1956–66 decade as a result of the anticipated large increase in construction activity (see discussion, p. 229), but employment of plasterers will increase less rapidly than construction activity as a whole. One factor is the expected continued trend toward greater use of drywall (nonplaster) construction. In addition, ornamental plastering is being used much less extensively in large office buildings, banks, churches, theaters, and hotels. Moreover, technological developments affecting the plastering operation is resulting in more plastering work done per worker. For example, it is expected that there will be increased use of machines for spraying lightweight plaster upon wall and ceiling surfaces, thus eliminating much handwork. On the other hand, several developments are expected to result in greater use of plaster. One of these is the increasing use of lightweight plasters in fireproofing structural steel. Another is the marked style trend toward the greater use of curved surfaces and ceilings made of plaster, both as a form of architectural treatment and to achieve special lighting effects.

Earnings and Working Conditions

Hourly pay rates for plasterers rank among the highest in the skilled building trades. However, their annual earnings are lower than the average for the skilled building trades as a group. In slack periods, plasterers generally cannot augment their earnings by doing maintenance and repair work, as much as other building craftsmen.

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for plasterers in the 52 large cities surveyed was $3.50, compared with $3.22 for all journeymen in the building trades. (Wage rates for this trade may vary within the same city depending upon the type of work performed and the working conditions.) Among the individual cities the minimum union hourly wage rates ranged from $2.50 in Charlotte, N. C., to $4 in Newark and New York, as shown in the following tabulation:

Atlanta, Ga	$3.00
Baltimore, Md	3.25
Birmingham, Ala	2.92
Boston, Mass	3.50
Buffalo, N. Y	3.52

Charlotte, N. C	$2.50
Chicago, Ill	3.55
Cincinnati, Ohio	3.38
Cleveland, Ohio	3.58
Columbus, Ohio	3.17
Dallas, Tex	3.44
Dayton, Ohio	3.27
Denver, Colo	3.30
Des Moines, Iowa	3.10
Detroit, Mich	3.51
Erie, Pa	3.25
Grand Rapids, Mich	3.30
Houston, Tex	3.38
Indianapolis, Ind	3.35
Jacksonville, Fla	2.80
Kansas City, Mo	3.38
Knoxville, Tenn	3.00
Little Rock, Ark	3.07
Los Angeles, Calif	3.63
Louisville, Ky	3.30
Memphis, Tenn	3.00
Milwaukee, Wis	3.28
Minneapolis–St. Paul, Minn	3.05–3.15
Newark, N. J	4.00
New Haven, Conn	3.25
New Orleans, La	2.81
New York, N. Y	4.00
Oklahoma City, Okla	3.30
Omaha, Nebr	3.20
Peoria, Ill	3.50
Philadelphia, Pa	3.65
Pittsburgh, Pa	3.45
Portland, Oreg	3.25
Providence, R. I	3.38
Richmond, Va	2.92
Rochester, N. Y	3.51
St. Louis, Mo	3.43
Salt Lake City, Utah	3.13
San Antonio, Tex	3.38
San Francisco–Oakland, Calif	3.54–3.56
Scranton, Pa	3.00
Seattle, Wash	3.28
Spokane, Wash	3.32
Springfield, Mass	3.28
Syracuse, N. Y	3.33
Toledo, Ohio	3.40
Washington, D. C	3.45

A large proportion of plasterers are members of unions. They are represented either by the Bricklayers, Masons and Plasterers International Union of America or the Operative Plasterers' and Cement Masons' International Association of the United States and Canada. Union-employer contracts covering plasterers usually provide health and life insurance and pension benefits, either financed entirely by employers or jointly by workers and employers.

Plastering requires considerable standing, stooping, and lifting. Most of the plastering work is done indoors.

Where To Go for More Information

A young man who wishes to obtain further information regarding plastering apprenticeships or work opportunities in the trade should apply to a plastering contractor in his area; locals of the plasterers' unions (Operative Plasterers' and Cement Masons' International Association of the United States and Canada, or the Bricklayers, Masons and Plasterers International Union of America); or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Bricklayers, Masons and Plasterers International Union of America,
815 15th St., NW., Washington 5, D. C.

National Bureau of Lathing and Plastering,
311 Tower Bldg., 1401 K St., NW., Washington 5, D. C.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada,
Second Federal Bldg., 335 Euclid Ave., Cleveland 14, Ohio.

Cement Finishers (Cement Masons)

(D. O. T. 5–26.100 and .200)

Nature of Work

The principal work of cement finishers (also known as cement masons or concrete masons) is finishing the exposed concrete surfaces of floors, walls, streets, and driveways, in order to make them strong and durable and, where necessary, relatively watertight. On small jobs, the cement mason pours or directs the pouring of concrete into forms or on carefully prepared bases. He then levels and settles the concrete, usually by tamping it or by vibrating it with a special machine. The surface of the concrete is then worked with a straightedge (a long flat board), a wood float (a tool shaped like a mortar board), and other

Cement mason finishing wall surface using steel trowel.

handtools in order to bring it to the desired grade (level). The cement finisher also slopes and shapes the concrete, and removes all depressions and high spots. Final finishing is often delayed for several hours until the concrete has hardened sufficiently to prevent small stones from working their way up to the surface. At this stage, when the concrete is still workable, the cement mason works it with a trowel to bring the concrete to the proper consistency and obtain a final finish. The final finishing may also be done by means of hand grinders or electrically operated grinders.

On most concrete building projects, finishing work generally involves hand operations. On highways and other large-scale projects, however, cement finishing machines are used extensively, but supplementary hand operations are also necessary, particularly to finish curved surfaces.

Cement masons also do patching work to correct surface defects on concrete structures. Some cement masons specialize in laying a mastic base over concrete, particularly in buildings where sound-insulated or acid-resistant floors are specified. The mastic (a fine asphalt mixture) is applied hot over the concrete and then smoothed with heavy handtools.

On large jobs, cement finishers work in gangs or crews. Helpers assist the cement finishers in performing all but the final finishing operations and laborers do the routine and heavy work.

Where Employed

Most cement masons work in the construction industry. They work principally on large buildings although many are employed on highway or other nonbuilding construction. Cement masons work directly for general contractors who have contracts to construct entire projects such as highways, or large industrial, commercial, and residential buildings. They also work for cement contractors who perform subcontracting or who work on such smaller projects as sidewalks, driveways, and basement floors. A small number work for municipal public works departments, utilities, and manufacturing firms which do their own construction work. Some cement masons are self-employed and do small cement jobs, such as sidewalks, steps, and driveways.

Cement masons are employed in almost every community in the country. Their employment distribution is similar to that of the building trades generally. (See discussion, p. 227.)

Training and Other Qualifications

Completion of a 3-year apprenticeship program for cement finishers is recommended by training authorities generally as the best way to learn this trade. A substantial proportion of cement masons, however, have learned the trade informally. They have picked up the trade by working for several years as helpers, observing or being taught by experienced cement masons.

Apprenticeship applicants are generally required to be between the ages of 18 and 25. Good physical condition and manual dexterity are important assets. Many apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Generally the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship registration agency or the United States Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program usually consists of 6,000 hours of on-the-job training plus related instruction. During the apprenticeship period the apprentice learns how to use and handle the tools and materials of the trade. He learns finishing, layout work, and safety techniques. He also receives related instruction in such subjects as applied mathematics and related sciences, blue-

print reading, architectural drawing, estimating materials and costs, and local building regulations. Although a high school education is not required, education above grade school level, preferably including mathematics, is needed to understand the classroom instruction.

Employment Outlook

A continued rapid increase in the employment of these workers is expected during the late 1950's and the 1960's. This occupation is expected to grow at a faster rate than the building trades as a whole. In addition to openings resulting from the growth of the trade, replacement needs will create a small number of other job opportunities for new workers.

The employment of cement masons has shown one of the fastest rates of growth among building trades craftsmen in recent years. The number of cement masons increased from about 15,000 in 1940, to 30,000 in 1950, and to about 40,000 in mid-1956. The anticipated large expansion of construction activity is expected to result in continued rapid growth in this occupation in the 1956–66 decade. Moreover, the relatively greater use of concrete construction in recent years is likely to continue. Recent technological developments, such as cement finishing machines, will have some adverse effect on employment prospects in the cement finishing trade. However, the expected increase in the total amount of cement finishing work will be sufficiently great to result in a substantial employment increase in this relatively small building trade.

Earnings and Working Conditions

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for cement finishers in the 52 large cities surveyed was $3.11. Among the individual cities, the minimum union hourly wage rates ranged from $2.20 in Charlotte, N. C., to $4 in Newark, as shown in the following tabulation:

Atlanta, Ga	$2.75
Baltimore, Md	2.95
Birmingham, Ala	2.78
Boston, Mass	3.54
Buffalo, N. Y	3.21
Charlotte, N. C	$2.20
Chicago, Ill	3.25
Cincinnati, Ohio	3.15
Cleveland, Ohio	3.58
Columbus, Ohio	2.78
Dallas, Tex	2.88
Dayton, Ohio	3.00
Denver, Colo	2.98
Des Moines, Iowa	3.05
Detroit, Mich	3.12
Erie, Pa	3.00
Grand Rapids, Mich	2.88
Houston, Tex	3.00
Indianapolis, Ind	3.00
Jacksonville, Fla	2.28
Kansas City, Mo	2.95
Knoxville, Tenn	2.61
Little Rock, Ark	2.55
Los Angeles, Calif	2.93
Louisville, Ky	3.00
Memphis, Tenn	2.55
Milwaukee, Wis	2.95
Minneapolis–St. Paul, Minn	3.10
Newark, N. J	4.00
New Haven, Conn	3.25
New Orleans, La	2.63
New York, N. Y	3.75
Oklahoma City, Okla	2.85
Omaha, Nebr	2.90
Peoria, Ill	3.22
Philadelphia, Pa	3.38
Pittsburgh, Pa	3.25
Portland, Oreg	2.90
Providence, R. I	3.05
Richmond, Va	2.23
Rochester, N. Y	3.51
St. Louis, Mo	3.53
Salt Lake City, Utah	2.70
San Antonio, Tex	2.75
San Francisco–Oakland, Calif	3.00
Scranton, Pa	2.85
Seattle, Wash	2.90
Spokane, Wash	2.90
Springfield, Mass	3.28
Syracuse, N. Y	3.08
Toledo, Ohio	3.40
Washington, D. C	3.15

Because of the seasonal nature of construction work and because of time lost for other reasons, the average annual earnings of cement finishers are not as high as their hourly rates of pay would indicate. Cement masons usually receive premium pay for hours worked in excess of the regularly scheduled workday or workweek. The need for overtime work for these craftsmen often arises because once concrete has been poured for a job, the work must be completed.

A large proportion of cement masons are union members. They belong to either the Operative

Plasterers' and Cement Masons' International Association of the U. S. and Canada or the Bricklayers, Masons and Plasterers International Union of America. Union-employer contracts covering cement finishers often provide health insurance and pension benefits, either financed entirely by employers or jointly by the workers and employers.

The work of the cement mason is active and strenuous, as it is in the skilled building trades generally. It requires stooping, bending, and kneeling since most cement finishing is done on floors or on ground level. Much of the work is done outdoors.

Where To Go for More Information

A young man who wishes to obtain further information regarding cement finishing apprenticeships or work opportunities in the trade should apply to a cement finishing contractor in his area; locals of the Operative Plasterers' and Cement Masons' International Association of the U. S. and Canada or the Bricklayers, Masons and Plasterers International Union of America; or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Associated General Contractors of America, Inc.,
Munsey Bldg., Washington 4, D. C.

Bricklayers, Masons and Plasterers International Union of America,
815 15th St., NW., Washington 5, D. C.

Operative Plasterers' and Cement Masons' International Association of the U. S. and Canada,
Second Federal Bldg., 335 Euclid Ave., Cleveland 14, Ohio.

Lathers

(D. O. T. 5–32.761, .762, and .763)

Nature of Work

Lathers install the supporting backings on ceilings or walls on which plaster or other materials are applied. These backings are usually metal lath (pieces of iron or light iron that often resemble wire netting), or large pieces of perforated gypsum board.

When installing metal lath, for example, the lathers first build a light iron framework (furring) which is fastened securely to the framing. The lath is then attached to the furring by nailing, clipping, or tying. After the lath has been installed, the lathers cut openings in it for electrical outlets and heating and ventilating pipes. This method of installation varies somewhat in other types of lath work. For example, for plaster cornices, the lather builds a framework that approximates the desired shape or form of the cornice. He then attaches metal lath to the framework. Gypsum lath is nailed on studs or clipped to the iron furring. Lathers also install corner beads (metal reinforcement used as corner protection) and similar supplementary items. When stucco is to be applied over wood framework, the lather nails coarse mesh wire to the framework preparatory to plastering.

The tools of the trade include measuring rules and tapes, drills, hammers, chisels, hack saws, shears, wire cutters, bolt cutters, punches, pliers, and hatchets.

Where Employed

Most lathers work for lathing and plastering contractors on new residential, commercial, or industrial construction. They also work on modernization and alteration jobs. Some lathers are also employed outside the construction industry; for example, they make the lath backing for plaster display materials or scenery. Most of the 20,000 lathers employed in mid-1956 had jobs in the larger urban areas.

Training and Other Qualifications

Completion of a 2-year apprenticeship program for lathers is the minimum training period recommended by training authorities generally as the best way to learn this trade. The majority of apprenticeship programs last 3 or 4 years. In smaller communities lathers may learn the trade informally. They pick up the trade by working for several years as helpers, observing or being taught by experienced lathers.

Apprenticeship applicants are generally required to be between the ages of 16 and 26, and in good physical condition. Aptitude tests are often given to applicants to determine their manual dexterity as well as the other qualifications required for this trade. Many apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Apprentices generally must pass examinations which are given at the end of each 6-month period. Generally the apprentice is covered by a union apprenticeship agreement and the program is registered with a State apprenticeship agency or the United States Department of Labor's Bureau of Apprenticeship and Training.

The apprenticeship program usually consists of 4,000 hours of on-the-job training plus related instruction. During the apprenticeship period the apprentice learns how to use and handle the tools and materials of the trade. For example, the apprentice installs gypsum and composition board, wall furring and metal lathing. In addition, the apprentice generally receives related instruction in such subjects as applied mathematics, geometry, reading of blueprints and sketches, welding, estimating, and safety practices. Although a high school education is not required, education above grade school level, particularly courses in mathematics, is needed to understand the classroom instruction.

Hourly wage rates for lather apprentices generally start at 50 percent of the journeyman rate. The rate is increased periodically by 5 percent every third or fourth month until a rate of 85 percent is reached in the final quarter of the second year of training.

Employment Outlook

A moderate increase in employment in this relatively small building trade is expected in the late 1950's and the 1960's. The growth of the trade will result principally from the anticipated large expansion in construction activity. (See discussion, p. 229.) Moreover, such developments as the increased use of acoustical tile for sound installation and the trends toward suspended and other decorative types of ceilings which require lath backing, will create more work for lathers. Similarly, the increased use of lightweight plasters as a fireproofing material for structural steel will mean more work for these craftsmen. These developments may largely offset the loss of lathing work resulting from the increasing use of dry walls, particularly in residential construction where these materials are often installed by carpenters.

Earnings and Working Conditions

The average hourly wage rates for lathers are among the highest in the skilled building trades. However, because of the seasonal nature of their work, their average annual earnings are lower than the hourly rates would appear to indicate.

The United States Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for lathers in the 52 large cities surveyed was $3.43, compared with $3.22 for all journeymen in the building trades. (Wage rates for this trade may vary within the same city depending upon the type of work performed and the working conditions.) Among the individual cities the minimum union hourly wage rates ranged from $2.50 in Memphis to $3.84 in San Francisco-Oakland, as shown in the following tabulation:

Atlanta, Ga	$3.00
Baltimore, Md	3.25
Birmingham, Ala	2.60
Boston, Mass	3.25
Buffalo, N. Y	3.45
Charlotte, N. C	2.75
Chicago, Ill	3.55
Cincinnati, Ohio	3.33
Cleveland, Ohio	3.58
Columbus, Ohio	3.17
Dallas, Tex	3.44
Dayton, Ohio	3.27
Denver, Colo	3.38
Des Moines, Iowa	3.10
Detroit, Mich	3.35
Erie, Pa	3.55
Grand Rapids, Mich	3.10
Houston, Tex	3.38
Indianapolis, Ind	3.23
Jacksonville, Fla	2.88
Kansas City, Mo	3.13
Knoxville, Tenn	2.85
Little Rock, Ark	3.07
Los Angeles, Calif	3.63
Louisville, Ky	3.13
Memphis, Tenn	2.50–3.00
Milwaukee, Wis	3.21
Minneapolis–St. Paul, Minn	3.05
Newark, N. J	3.60

New Haven, Conn	$3.30
New Orleans, La	2.68–2.83
New York, N. Y	3.65–3.75
Oklahoma City, Okla	3.30
Omaha, Nebr	3.10
Peoria, Ill	3.25
Philadelphia, Pa	3.00–3.53
Pittsburgh, Pa	3.45
Portland, Oreg	3.15
Providence, R. I	3.40
Richmond, Va	2.88
Rochester, N. Y	3.32
St. Louis, Mo	3.18–3.43
Salt Lake City, Utah	3.13
San Antonio, Tex	3.38
San Francisco–Oakland, Calif	3.44–3.84
Scranton, Pa	3.00
Seattle, Wash	3.18
Spokane, Wash	3.08
Springfield, Mass	3.10
Syracuse, N. Y	3.33
Toledo, Ohio	3.40
Washington, D. C	3.45

A large proportion of lathers are members of The Wood, Wire and Metal Lathers International Union. Union-employer contracts covering lathers usually provide health, life insurance, pension, and other benefits, either financed entirely by employers or jointly by the workers and employers.

Where To Go for More Information

For further information regarding lathers' apprenticeships or work opportunities in the trade a young man should apply to a lathing contractor in his area, a local of The Wood, Wire and Metal Lathers International Union; or a local, joint union-employer apprenticeship committee, if there is one in his area. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be optained from:

The Wood, Wire and Metal Lathers International Union,
7214 New Hampshire Ave., NW., Takoma Park, Md.

National Bureau of Lathing and Plastering,
311 Tower Bldg., 1401 K St. NW., Washington 5, D. C.

Stonemasons

(D. O. T. 5–24.210)

Nature of Work

Stonemasons build the stone exteriors of structures. They work primarily with two types of stones—natural cut stone, such as marble, granite, or sandstone; and artificial stone which is made to order for industrial buildings. These craftsmen use the same skills and techniques whether they work with natural cut stone or artificial stone.

Much of the work of these craftsmen is the setting of natural cut stone for comparatively expensive buildings such as offices, hotels, churches, and public buildings. In this type of work, the stonemason works from a set of drawings in which each stone has been numbered for identification purposes, except where every piece is identical. A helper or derrickman locates the pieces needed and brings them to the mason; larger stones are set and placed with a hoist. The stonemason sets the stone in mortar and moves it into final position with a mallet, hammer, or crowbar. He alines the stone with a plumb line and finishes the joints between the stones with a pointing trowel. He may fasten the stone to supports with metal ties or anchors.

Occasionally the stonemason may have to cut stone to size. To do this he must determine the grain of the stone selected and strike blows along a predetermined line with a stonemason's hammer. More valuable stones are cut with an abrasive saw to make them fit.

Stonemasons also do a small amount of stone veneer work, in which a thin covering of cut stone is applied to the exterior surfaces of a building. They also do work on piers, retaining walls, abutments, flagstone walks, and curbstones. In one specialized branch of the trade known as alberene-stone setting, stonemasons set acid-resistant soapstone linings for vats, tanks, and floors.

The principal handtools of the stonemasons are heavy hammers, wooden mallets, and chisels. For rapid stone cutting, pneumatic tools are used, such as pneumatic hammers, pneumatic drills, and brushing tools. Special power tools are used for smoothing the surface of large stones, and for cutting, an abrasive saw is used on mortar and sandstone.

Where Employed

Most stonemasons work on new building construction, particularly on the more expensive residential and commercial buildings. A few work for government agencies or business establishments which do their own construction and alteration work. Journeymen stonemasons are employed mainly in the larger urban areas. In many areas where there are no stonemasons, the work is performed by bricklayers who are often skilled in doing stone masonry work.

Training and Other Qualifications

Completion of a 3-year apprenticeship program for stonemasons is recommended by training authorities generally as the best way to learn this trade. However, a substantial proportion of stonemasons have picked up the trade by working several years as helpers, observing or being taught by experienced stonemasons.

Apprenticeship applicants are generally required to be between the ages of 17 and 24; a high school education or its equivalent is desirable. Good physical condition is an important asset.

The apprenticeship program for stonemasons generally requires 6,000 hours of on-the-job training in the use and handling of the tools, machines, and materials of the trade. During the apprenticeship, the trainee learns how to lay out and install walls, floors, stairs, and arches; and how to work with the various kinds of natural and artificial stone. The apprentice training program in this occupation is similar in all important respects to that of bricklayers. (See p. 246.)

Employment Outlook

Little increase in the employment of stonemasons is expected during the late 1950's and the 1960's despite the anticipated large expansion in new building construction. Replacement needs will provide a small number of job opportunities for new workers each year in this relatively small building trade.

Earnings and Working Conditions

Hourly wage rates for stonemasons are among the highest in the skilled building trades. Their average annual earnings, however, are much less than their hourly rates would indicate since these workers lose much work time because of weather conditions and the brief duration of jobs.

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for stonemasons in the 52 large cities surveyed was $3.50, compared with $3.22 for all journeymen in the building trades. (Wage rates for this trade may vary within the same city depending upon the type of work performed and the working conditions.) Among the individual cities the minimum union hourly wage rates ranged from $3.02 in Philadelphia to $4.05 in New York, as shown in the following tabulation:

Atlanta, Ga	$3.35
Baltimore, Md	3.45
Birmingham, Ala	3.50
Boston, Mass	3.50
Buffalo, N. Y	3.49
Charlotte, N. C	----
Chicago, Ill	3.68
Cincinnati, Ohio	3.60
Cleveland, Ohio	3.55
Columbus, Ohio	3.40–3.50
Dallas, Tex	3.70
Dayton, Ohio	3.60
Denver, Colo	3.63
Des Moines, Iowa	3.65
Detroit, Mich	3.63
Erie, Pa	3.45
Grand Rapids, Mich	3.45
Houston, Tex	3.69
Indianapolis, Ind	3.63
Jacksonville, Fla	3.10
Kansas City, Mo	3.38
Knoxville, Tenn	----
Little Rock, Ark	3.40
Los Angeles, Calif	3.80
Louisville, Ky	3.58
Memphis, Tenn	3.75
Milwaukee, Wis	3.40
Minneapolis–St. Paul, Minn	3.43
Newark, N. J	4.00
New Haven, Conn	3.25
New Orleans, La	3.25
New York, N. Y	4.00–4.05
Oklahoma City, Okla	3.50
Omaha, Nebr	3.38
Peoria, Ill	3.55
Philadelphia, Pa	3.02–3.75
Pittsburgh, Pa	3.60
Portland, Oreg	3.50
Providence, R. I	3.33
Richmond, Va	3.25
Rochester, N. Y	3.51
St. Louis, Mo	3.75
Salt Lake City, Utah	3.25

San Antonio, Tex	$3.38
San Francisco-Oakland, Calif	3.75
Scranton, Pa	3.38
Seattle, Wash	3.55
Spokane, Wash	3.55
Springfield, Mass	3.28
Syracuse, N. Y	----
Toledo, Ohio	3.51
Washington, D. C	3.65

A large proportion of stonemasons are members of the Bricklayers, Masons and Plasterers International Union of America. Union-employer contracts covering stonemasons usually provide health insurance and pension benefits, either financed entirely by employers or jointly by the workers and employers.

Most stonemasonry work is done outdoors. The work of the stonemason is active and sometimes even strenuous, as it involves lifting moderately heavy materials.

Where To Go for More Information

A young man who wishes to obtain further information regarding apprenticeships for stonemasons or work opportunities in this trade should apply to bricklaying contractors in his area, to a local of the Bricklayers, Masons and Plasterers International Union of America; or to a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service serves as a source of information and a contact point for apprenticeship openings.

Additional information may be obtained from:

Associated General Contractors of America, Inc., Munsey Bldg., NW., Washington 4, D. C.

Bricklayers, Masons and Plasterers International Union of America,
815 15th St. NW., Washington 5, D. C.

Elevator Constructors

(D. O. T. 5-83.350 through .359)

Nature of Work

Elevator constructors (elevator mechanics) assemble and install elevators, escalators, dumb waiters, and similar equipment. The work is done by small crews (seldom more than six men) consisting of journeymen (skilled) mechanics and helpers.

In elevator construction work, the crew first installs the guide rails of the car in the elevator shaft of the building. Then they install the car frame and platform, the counterweight, the elevator chassis, and the control apparatus. Next, the car frame is connected to the counterweight with cables, the cab body and roof are installed, and the control system is wired. Finally, the entire assembly including cables, wire, and electrical control apparatus is carefully adjusted and tested.

Modernization, maintenance, and repair are important parts of the work of elevator constructors. In maintenance and repair work, these workers inspect elevator and escalator installations periodically and, when necessary, adjust cables and parts and lubricate or replace parts. Alteration work on elevators is important because of the rapid rate of innovations and improvement in elevator engineering. This work is similar to new installation work because all elevator equipment except the old rail, car frame, platform, and counterweight are generally replaced.

In order to install and repair electrical, hydraulic, steam, or compressed air elevators, many of which are electrically controlled, these workers must have a working knowledge of electricity, electronics, and hydraulics. They must also be able to repair electric motors and control and signal systems. Because of the variety of their work, they use many different handtools and powertools.

Where Employed

Most elevator constructors work mainly for elevator manufacturers, doing new installation and modernization work and elevator servicing. Some elevator constructors are employed by small, local contractors who specialize in elevator maintenance and repair. Others work for government agencies or business establishments which do their own elevator maintenance and repair. Elevator constructors are also employed as elevator inspectors for municipal or other governmental licensing and regulatory agencies. The jobs of the approximately 9,000 to 10,000 journeymen elevator constructors employed in

mid-1956 were concentrated in the highly industrialized and populated centers of the country.

Training and Other Qualifications

Although elevator constructors are among the more highly skilled building craftsmen, training is comparatively informal and is obtained through employment as a helper for a number of years. The helper-trainee must be at least 18 years of age, in good physical condition, and have a high school education or its equivalent, preferably including courses in mathematics and physics. Mechanical aptitude and an interest in machines are important assets.

Generally, at least 2 years of continuous job experience, including 6 months' on-the-job training at the factory of a major elevator firm, is necessary to acquire a journeyman's skill. During this period, the helper must acquire a detailed knowledge of the many different kinds of circuits used in modern as well as old installations, the many different kinds of mechanical arrangements that have been used and the proper sequence of actions in making adjustments. He must also learn how to recognize faulty adjustments and when to replace worn parts. The helper-trainee is generally required to attend evening classes in vocational schools. Among the subjects studied are mathematics, physics, electrical and electronic theory, and proper safety techniques.

Employment Outlook

Continued rapid increase in the rate of employment growth for elevator constructors is expected during the late 1950's and the 1960's. However, because of the small size of this occupation there will only be several hundred job openings annually for new workers in this trade.

Increasing numbers of elevator constructors will be needed as the result of the anticipated large expansion in new industrial, commercial, and large residential building. Modernization of older elevator and escalator installations will also contribute to the growing need for these workers. Technological advances in elevator and escalator construction will result in more work for these craftsmen. The modern high-speed, complex elevators, with their automatic door openings and automatic leveling at floors, require more work and higher skill for the installation and adjustment of electrical and electronic controls.

Earnings and Working Conditions

Both the hourly wage rates and the annual earnings of elevator constructors are among the highest in the skilled building trades. These craftsmen lose less worktime because of seasonal factors than do most other building trades workers.

The wage rates paid to most elevator constructors are based on an agreement between the International Union of Elevator Constructors and the major elevator manufacturers. In mid-1956, this agreement provided that the local wage rates for elevator mechanics shall be the average of the wage rates paid in the area to the five highest of the following building trades: Bricklayers, plasterers, carpenters, electricians, sheet metal workers, plumbers and steamfitters, and iron workers. Helpers' rates are generally 70 percent of the journeymen's rates.

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for elevator constructors in the 52 large cities surveyed was $3.36. Among the individual cities, the minimum union hourly wage rates ranged from $2.88 in Richmond, Va., to $3.83 in Newark and New York, as shown in the following tabulation:

Atlanta, Ga	$3.05
Baltimore, Md	3.18
Birmingham, Ala	3.10
Boston, Mass	3.21
Buffalo, N. Y	3.22
Charlotte, N. C	----
Chicago, Ill	3.51
Cincinnati, Ohio	3.31
Cleveland, Ohio	3.39
Columbus, Ohio	3.28
Dallas, Tex	3.23
Dayton, Ohio	3.31
Denver, Colo	3.19
Des Moines, Iowa	3.16
Detroit, Mich	3.50
Erie, Pa	3.19
Grand Rapids, Mich	3.21
Houston, Tex	3.25
Indianapolis, Ind	3.23
Jacksonville, Fla	2.99
Kansas City, Mo	3.28
Knoxville, Tenn	3.00
Little Rock, Ark	3.04
Los Angeles, Calif	3.47
Louisville, Ky	3.22
Memphis, Tenn	3.05
Milwaukee, Wis	3.09

Minneapolis–St. Paul, Minn	$3.15
Newark, N. J	3.83
New Haven, Conn	3.28
New Orleans, La	2.98
New York, N. Y	3.83
Oklahoma City, Okla	3.23
Omaha, Nebr	3.09
Peoria, Ill	3.29
Philadelphia, Pa	3.70
Pittsburgh, Pa	3.42
Portland, Oreg	3.21
Providence, R. I	3.05
Richmond, Va	2.88
Rochester, N. Y	3.40
St. Louis, Mo	3.50
Salt Lake City, Utah	2.95
San Antonio, Tex	3.12
San Francisco–Oakland, Calif	3.40
Scranton, Pa	3.15
Seattle, Wash	3.19
Spokane, Wash	3.19
Springfield, Mass	3.21
Syracuse, N. Y	3.22
Toledo, Ohio	3.35
Washington, D. C	3.50

Most elevator constructors belong to the International Union of Elevator Constructors. Union-employer contracts covering elevator workers usually provide health insurance, either financed entirely by employers or jointly by the employers and workers.

Opportunities for establishing an individually owned small contracting business in this field are very limited.

Some work operations in elevator construction involve manual labor and this is usually done by the helpers. Also, much of the work must be done in cramped or awkward positions. The work is done indoors.

Where To Go for More Information

A young man who wishes to obtain further information regarding work opportunities as a helper in this trade should contact an elevator manufacturer, an elevator contractor, or a local of the International Union of Elevator Constructors, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for work opportunities in this trade.

Additional information may be obtained from:

International Union of Elevator Constructors,
12 South 12th St., Philadelphia 7, Pa.

Marble Setters, Tile Setters, and Terrazzo Workers

(D. O. T. 5–24.310, .410, and .510)

Nature of Work

Marble setters, tile setters, and terrazzo workers cover interior or exterior walls, floors, or other surfaces with marble, tile, or terrazzo. These are distinct trades. Workers in each trade work primarily with the material indicated by their title.

The tile setter attaches tile (a thin slab of baked clay, stone, or other material) on walls, floors, or ceilings according to blueprints or other instructions. For walls and ceilings, a plaster coat and then a layer of cement are applied to the surface or other supporting backing, such as plaster board or metal lath. The tiles are then tapped into place with a trowel or handle. In laying tile floors, the tile setter adds cement to the fresh concrete subfloor and then lays the tile. He chips the tile with a hammer and chisel or cuts it with a blacksmith's pincers to make it fit into irregular areas, into corners, or around pipes.

Small tiles, such as those laid in bathrooms, are available in paper-backed strips and sheets that can be fastened to the floor as a unit, using cement, various types of adhesives, or mastic. This eliminates the need for the setting of individual tiles. The tile setter is usually assisted by a helper who mixes mortar, sets up scaffolds, supplies the setter with materials, fills the joints after the tile setting is completed, and cleans the completed work.

Terrazzo workers are skilled craftsmen who work with terrazzo which, essentially, is a type of ornamental, nonstructural concrete in which marble chips are used as the coarsest ingredient. The terrazzo is ground and polished after hardening to give a smooth surface in which the marble chips are exposed against the background of other materials.

A terrazzo worker starts his work by laying a base (first course) of fine, fairly dry concrete, leveling this accurately and tamping it. He then places metal strips wherever there is to be a joint, or a change of color between panels and imbeds their bottom edges in the first course. If there is to be lettering or an ornamental figure, he also

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imbeds a shop-made mold. Then he mixes the top course of concrete, pours it onto the base course, and levels it. There is, of course, a separate mixture for each color. After the concrete has hardened for a few days, the floor is ground and polished with an electric-powered grinding machine until there is a smooth, level surface.

In these operations, the terrazzo worker is assisted by helpers in the mixing and placing of the base course, but he alone does the leveling and placing of the metal strips. Helpers handle sand, cement, lime, terrazzo, and all other materials that may be used by the marble and terrazzo workers. They rub and clean all marble, mosaic, and terrazzo floors and perform other work required in helping a terrazzo mechanic. The terrazzo worker generally supervises mixing of the top course which, along with the grinding, governs its final appearance. The grinding is usually done by another worker.

Marble setters install marble, shop-made terrazzo panels and artificial marble, and structural glass when it is used in the interior of a building. The marble setter does little fabrication work because the marble and other materials are cut to size and polished before they are delivered to the work site. However, he may have to do some minor cutting to make the materials fit exactly. The marble setter lays out the work carefully, applies a special plaster mixture to the backing material and sets the marble pieces in place. When necessary, he braces them until the setting plaster has hardened. Special plaster is poured into the joints between the marble pieces and the joints are pointed up (slightly indented) with a trowel or wooden paddle. Bolt holes may have to be drilled if attachments to the marble are necessary. Usually, each marble setter has a helper or general assistant to prepare plaster, help carry marble slabs, and clean the surface of the completed work.

Where Employed

Marble setters, tile setters, and terrazzo workers are employed mainly in new building construction and generally in the larger urban areas. Significant concentrations of these workers are found in Florida, California, and Arizona.

Training, Other Qualifications, and Advancement

Completion of a 3-year apprenticeship program in each of these distinct trades is recommended by training authorities generally as the best way to learn these trades. A substantial proportion of tile setters, terrazzo workers, and marble setters, however, have learned these trades informally. They have picked up the trade by working several years as helpers, observing or being taught by experienced craftsmen.

Apprenticeship applicants are generally required to be between the ages of 17 and 22; a high school education or its equivalent is desirable. Good physical condition and manual dexterity are important aspects. Applicants should have an eye for quickly determining proper alinements of tile, terrazzo, and marble, and a discerning color sense.

Many apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement and the program is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training. The apprenticeship programs in each of these trades generally consist of 6,000 hours of on-the-job training, plus related instruction. During the apprenticeship, the apprentice learns how to use and handle tools and materials of the trades. He also receives related classroom instruction in blueprint reading, layout work, basic mathematics, and the making of measurement sketches. An illustration of a 3-year apprenticeship work schedule for terrazzo and mosaic workers follow:

Type of work	*Approximate hours*
Total	6,000
Use, care, and maintenance of tools	300
Handling, placing, and selecting materials according to design of job	500
Mixing, placing, tamping, and leveling terrazzo material	500
Mixing, placing, tamping, and leveling of concrete for base	100
Operating finishing machine	500
Selecting, setting, and leveling metal dividing strips	1,100
Preparing wood floor to receive terrazzo floor	200
Placing, screeding, and tamping terrazzo mix	700
Plastering in material	600
Rough screeding and rounding of bases and cove; leveling; and alining	700
Finishing base and cove; hand and machine rubbing	800

Hourly wage rates for apprentices in each of these trades start at about 50 or 60 percent of the journeyman rate and increase periodically until 95 percent of the journeyman rate is reached during the last period of apprenticeship training.

Skilled and experienced tile, terrazzo, or marble setters may become foremen. Others are able to start their own small contracting businesses.

Employment Outlook

There will be a small increase in employment in these trades during the late 1950's and the 1960's, primarily because of the anticipated large growth in new building construction (see discussion, p. 229).

Job openings for terrazzo workers are expected to increase faster than for marble setters and tile setters. The use of terrazzo, particularly for floors, has expanded in the postwar period, replacing tile and marble to some extent. There has been a shortage of highly skilled terrazzo workers in the postwar period and, as a result, some of these craftsmen have been recruited from abroad. The anticipated growth in employment of tile setters will be limited by the increased use of competing materials, such as asphalt floor tile, structural glass, plastic tile, and plastic-coated wallboard.

Little change in the employment of marble setters is expected. Despite the relatively higher costs of marble compared with competitive materials and the gradual depletion of the supply of quality marble, the excellent qualities of marble as a building material will insure its use and provide work for marble setters.

Earnings and Working Conditions

The U. S. Department of Labor's Bureau of Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for marble setters and terrazzo workers in the 52 large cities surveyed was \$3.28, and \$3.22 for tile setters. (Wage rates for these trades may vary within the same city, depending upon the type of work performed and the working conditions.) Among the individual cities, the minimum union hourly wage rates ranged from \$2.65 for marble setters, terrazzo workers, and tile setters in San Antonio to \$3.50 for tile setters in Peoria, Ill., \$3.60 for marble setters in Cincinnati, and \$3.70 for terrazzo workers in Newark and New York, as shown in the following tabulation:

	Marble setters	*Mosaic and terrazzo workers*	*Tile setters*
Atlanta, Ga	\$3. 35	\$3. 35	\$3. 35
Baltimore, Md	3. 25	3. 08	3. 08
Birmingham, Ala	3. 10	3. 10	3. 10
Boston, Mass	3. 25	3. 25	3. 25
Buffalo, N. Y	3. 24	3. 17	3. 17
Charlotte, N. C	2. 75	2. 75	2. 75
Chicago, Ill	3. 50	3. 45	3. 28–3. 45
Cincinnati, Ohio	3. 60	3. 33	3. 33
Cleveland, Ohio	3. 30	3. 30	3. 40
Columbus, Ohio	2. 93	2. 93	2. 93
Dallas, Tex	3. 00	3. 00	3. 00
Dayton, Ohio	3. 33	3. 33	3. 33
Denver, Colo	3. 20	3. 20	3. 20
Des Moines, Iowa	3. 00	3. 00	3. 00
Detroit, Mich	3. 53	3. 35	3. 35
Erie, Pa	3. 15	3. 15	3. 15
Grand Rapids, Mich	3. 45	3. 00	3. 00
Houston, Tex	3. 15	3. 15	3. 15
Indianapolis, Ind	3. 38	3. 37	3. 38
Jacksonville, Fla	2. 80	2. 80	2. 80
Kansas City, Mo	3. 30	3. 43	3. 43
Knoxville, Tenn	3. 35	3. 35	3. 35
Little Rock, Ark	2. 95	2. 95	2. 95
Los Angeles, Calif	3. 10	3. 32	3. 26
Louisville, Ky	3. 00	3. 00	3. 00
Memphis, Tenn	3. 05	3. 05	3. 05
Milwaukee, Wis	3. 26	3. 31	3. 15
Minneapolis–St. Paul, Minn	3. 05	3. 00	2. 95
Newark, N. J	-----	3. 70	3. 35
New Haven, Conn	3. 25	3. 25	3. 25
New Orleans, La	3. 25	2. 80	2. 80
New York, N. Y	3. 50	3. 70	3. 35
Oklahoma City, Okla	3. 08	3. 08	3. 08
Omaha, Nebr	3. 00	3. 00	3. 00
Peoria, Ill	3. 50	3. 50	3. 50
Philadelphia, Pa	3. 50	3. 56	3. 38
Pittsburgh, Pa	3. 20	3. 40	3. 25
Portland, Oreg	2. 70	2. 90	3. 15
Providence, R. I	3. 03	3. 03	3. 03
Richmond, Va	3. 00	2. 90	2. 90
Rochester, N. Y	3. 39	3. 39	3. 39
St. Louis, Mo	3. 25	3. 50	3. 00
Salt Lake City, Utah	2. 75	2. 75	2. 75
San Antonio, Tex	2. 65	2. 65	2. 65
San Francisco-Oakland, Calif	3. 34	2. 98	3. 23
Scranton, Pa	3. 05	3. 05	3. 05
Seattle, Wash	3. 35	3. 00	3. 23
Spokane, Wash	3. 38	3. 27	3. 27
Springfield, Mass	3. 28	3. 28	3. 28
Syracuse, N. Y	3. 10	3. 10	3. 10
Toledo, Ohio	3. 51	3. 33	3. 33
Washington, D. C	3. 55	3. 38	3. 38

A large proportion of the workers in each of these trades are members of one of the following unions—Bricklayers, Masons and Plasterers International Union of America; International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters Helpers & Terrazzo Helpers; and Operative Plasterers' and Cement Masons' International Association of the United States and Canada. Union-employer contracts covering these workers usually provide insurance and pension benefits, either financed entirely by the employers or jointly by the workers and employers.

Where To Go for More Information

To obtain further information regarding apprenticeships or work opportunities in these trades, a young man should apply to tile, terrazzo, and marble setting contractors in his area or to locals of the unions mentioned above. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Additional information may be obtained from:

Bricklayers, Masons and Plasterers International Union of America,
815 15th St. NW., Washington 5, D. C.

International Association of Marble, Slate and Stone Polishers, Rubbers and Sawyers, Tile and Marble Setters Helpers & Terrazzo Helpers,
815 15th St. NW., Washington 5, D. C.

Operative Plasterers' and Cement Masons' International Association of the United States and Canada,
Second Federal Building, 335 Euclid Ave., Cleveland 14, Ohio

National Terrazzo and Mosaic Association, Inc.
711 14th St. NW., Washington 5, D. C.

Tile Contractors' Association of America.
1420 New York Ave. NW., Washington 5, D. C

Glaziers

(D. O. T. 5–77.010)

Nature of Work

Glaziers cut, fit, and install plate glass (for store windows), ordinary window glass, mirrors, and special items such as preassembled stained glass or leaded glass panels. In making a glass installation, the glass is first cut to size. The glazier puts a bed of putty into the wood or metal sash and presses the glass into place. He fastens the glass with wire clips or triangular metal points and then places and smooths another strip of putty on the outside edges of the glass to keep out moisture.

When installing structural glass which is used to decorate building fronts, walls, ceilings, and partitions, the glazier (and sometimes the marble setter, see discussion, p. 274) applies mastic cement to the supporting backing and the glass is pressed into it. The glass may have to be trimmed with a glass cutter if it is not precut to specifications. Glaziers (as well as bricklayers, see p. 247) install glass blocks for building exteriors, interior partitions, and walls.

In addition to such handtools as glass cutters and putty knives, glaziers use power cutting tools and grinders.

Where Employed

In mid-1956, only a few thousand glaziers were employed by glazing contractors on new construction, alterations and modernizations, and replacement of broken glass, particularly store windows. Others were employed by government agencies or business establishments which do their own construction work.

A large number of glaziers work outside the construction industry. Many are employed in factories where they install glass in sash, doors, mirrors, and partitions. Other workers, using skills similar to those used by glaziers, install glass or mirrors in furniture and boats, or replace glass in automobiles.

Most glaziers are employed in large urban areas. In small communities, the work of the glazier is done by persons who also do painting or paperhanging.

Training and Other Qualifications

Completion of a 3-year apprenticeship program for glaziers is recommended by training authorities generally as the best way to learn this trade. A substantial proportion of glaziers, however,

have learned the trade informally. They have picked up the trade by working for several years and observing or being taught by experienced glaziers. In smaller communities, many journeymen painters and paperhangers have learned to do glazier work as part of the apprenticeship training for their trade.

Apprenticeship applicants are generally required to be at least 18 years of age; a high school education or its equivalent is desirable. Many glazier apprenticeship programs are under the supervision of local, joint employer-union apprenticeship committees. Generally, the apprentice is covered by a written apprenticeship agreement, and the program is registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship and Training. The apprenticeship program usually consists of 6,000 hours of on-the-job training, plus a minimum of 144 hours a year of related instruction. During the apprenticeship, the apprentice learns how to use and handle the tools, machines, and materials of the trade. The program includes on-the-job experience in the installation of wood and metal sashes, store fronts, structural glass, and mirrors. An illustration of a 3-year apprenticeship work program for glaziers in construction work follows:

Tools, equipment, shop training, scaffold, safety measures and first aid, also reading of specifications and field blueprint reading.

Glazing wood and metal sash, doors, partitions, and all other types of openings.

Setting all types of store front installations.

Setting all types of structural glass both interior and exterior.

Setting all types of plate glass, prism glass, beveled glass, automobile glass, protective glass, window glass, mirrors of all types, wire glass, ribbed glass, ground glass, colored glass, figured glass, vitrolite, carrara glass, and all other types of opaque glass, glass chalk boards, tempered glass, Thermopane, window and all other similar types of insulated glass, all plastics, or other similar materials when used in place of glass, to be set or glazed with putty, molding, rubber and all types of mastics in wood, iron, aluminum, or sheet metal sash, skylights, doors, frames, stone, wall cases, showcases, bookcases, sideboards, partitions and fixtures, either temporary or permanent, on or for any building in the course of construction or repair or replacement.

Setting shower doors and tub enclosures.

Setting architectural glass, monitors, and T. and L. sash.

Setting all types of multiple glazed units.

Setting all types of automatic doors, hinges, and prefabricated units.

Handling and use of all products associated with the glass industry.

Replacement of any and all the above named materials.

All types of miscellaneous glazing.

Hourly wage rates of glazier apprentices start at about 50 percent of the journeyman rate and increase periodically until the journeyman rate is reached at the completion of training. If apprenticeship applicants have had experience directly related to the trade, they may be granted advanced apprenticeship standing.

Employment Outlook

There will be several hundred opportunities each year for new workers to enter this relatively small field of work during the late 1950's and the 1960's. The anticipated large expansion of construction activity in the 1956–66 decade (see discussion, p. 229) and the trend toward an increasing use of glass in buildings are expected to result in more glazing work. Replacement work and modernization work, frequently involving large glass installations, will continue to provide additional job opportunities for glaziers.

Earnings and Working Conditions

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for glaziers in the 52 large cities surveyed was $2.93. (Wage rates for this trade may vary within the same city depending upon the type of work performed and the working conditions.) Among the individual cities, the minimum union hourly wage rates ranged from $1.75 in Charlotte, N. C., to $3.75 in New York, as shown in the following tabulation:

Atlanta, Ga	$2.75
Baltimore, Md	2.73
Birmingham, Ala	2.65
Boston, Mass	2.68
Buffalo, N. Y	2.80
Charlotte, N. C	1.75
Chicago, Ill	3.57
Cincinnati, Ohio	3.15
Cleveland, Ohio	3.38
Columbus, Ohio	2.55
Dallas, Tex	2.68
Dayton, Ohio	2.85
Denver, Colo	2.63
Des Moines, Iowa	2.60
Detroit, Mich	2.98

Erie, Pa	$2.50
Grand Rapids, Mich	2.67
Houston, Tex	2.78
Indianapolis, Ind	3.17
Jacksonville, Fla	2.38
Kansas City, Mo	3.00
Knoxville, Tenn	2.20
Little Rock, Ark	2.31
Los Angeles, Calif	2.89
Louisville, Ky	2.70
Memphis, Tenn	2.35
Milwaukee, Wis	2.77
Minneapolis–St. Paul, Minn	2.56
Newark, N. J	3.33
New Haven, Conn	----
New Orleans, La	2.63
New York, N. Y	3.75
Oklahoma City, Okla	2.55
Omaha, Nebr	2.58
Peoria, Ill	2.85
Philadelphia, Pa	3.00–3.23
Pittsburgh, Pa	3.00
Portland, Oreg	2.81
Providence, R. I	2.75
Richmond, Va	1.90
Rochester, N. Y	2.80
St. Louis, Mo	3.45
Salt Lake City, Utah	2.46
San Antonio, Tex	2.50
San Francisco–Oakland, Calif	2.85
Scranton, Pa	2.40
Seattle, Wash	2.77
Spokane, Wash	2.61
Springfield, Mass	$2.90
Syracuse, N. Y	2.68
Toledo, Ohio	2.85
Washington, D. C	3.00

A large proportion of glaziers employed in construction work are members of the Brotherhood of Painters, Decorators and Paperhangers of America. Union-employer contracts covering glaziers usually provide health insurance and pension benefits, either financed entirely by the employers or jointly by the employers and workers.

Where To Go for More Information

A young man who wishes to obtain further information regarding glazier apprenticeships or work opportunities in this trade should contact a glazing contractor or general contractor in his area, a local of the Brotherhood of Painters, Decorators and Paperhangers of America, or a local, joint union-employer apprenticeship committee, if there is one in his locality. In addition, the local office of the State employment service may be a source of information and a contact point for apprenticeship opportunities.

Further information may be obtained from:

Brotherhood of Painters, Decorators and Paperhangers of America,
217–219 North 6th St., Lafayette, Ind.

Asbestos and Insulating Workers

(D. O. T. 5-33.110 and .210)

Nature of Work

The principal work of asbestos and insulating workers is to install insulating materials. These prepared materials serve a number of functions: for example, to prevent the absorption of heat, as in refrigeration installations, and to retain heat and thus save fuel as in the insulation of boilers, pipes, and furnaces.

The asbestos worker covers the pipes in which hot or cold liquids are carried by pasting, wiring, or taping them with sections of prepared insulating materials, such as cork, felt, or corrugated paper with an inner lining of asbestos paper. Spun glass is used to cover pipes which carry very hot or cold liquids. Boilers, tanks, and kettles are covered with prepared insulating material in sheet form. This flat stock is skillfully cut so that it can be wired onto the surfaces to be insulated. Sometimes vessels may be insulated with a paste of asbestos mixed with other materials which is then covered with a cloth wrapping. Another important type of work done by these workers is to nail, paste, or wire insulating linings to walls, ceilings, floors, and pipes of cold storage units. These workers also install sound-absorbing materials in rooms where particular acoustical effects are desired. In doing this work, they often use power-driven machines that blow adhesive sound-absorbing asbestos material on the surfaces to be insulated.

Where Employed

Most asbestos workers are employed by asbestos contractors in new industrial and commercial construction. A substantial number are also employed in alteration and maintenance work. Some types of chemical plants and other industrial establishments, which have extensive steam installations

for power and heating, employ asbestos workers for alterations and maintenance of their insulated pipe work. Similarly, some large establishments which have cold storage facilities employ asbestos workers for maintenance work. Asbestos workers are found in almost every part of the country, with large concentrations in the more highly populated and industrialized centers. In home construction, carpenters or other building trades workers, rather than asbestos workers, often install insulation materials.

Training and Other Qualifications

Most asbestos workers learn their trade through a 4-year "improvership" program that is similar in many respects to apprenticeship programs found in other building trades. The improvership program consists of a specified period of on-the-job training in which the new worker learns how to handle the tools of the trade and to work with the various kinds of insulating materials.

Applicants for improvership programs are generally required to be between the ages of 18 and 30 and in good physical condition. Hourly wage rates under the improvership programs start at about 50 percent of the journeyman's rate, and if the trainee's work progresses satisfactorily, increase by about 10 percent each year until 80 percent of the journeyman rate is reached during the final stage of the program. At the end of the 4-year improvership program, trainees are required to pass an examination which demonstrates their knowledge of the trade.

Employment Outlook

Employment in this relatively small building trade is expected to increase rapidly during the late 1950's and the 1960's as a result of the anticipated sharp rise in the volume of construction of commercial and industrial buildings. (See discussion, p. 229.) Moreover, the increasing use of industrial pipe, required for numerous manufacturing processes, such as those found in the petroleum and chemical industries and in industries where refrigeration and air-conditioning installations are used, will require increasing numbers of asbestos workers for installation and maintenance work. In addition to job openings resulting from the growth of the trade, other job opportunities will be created by the need to replace workers who die, retire, or transfer to other fields of work. Deaths and retirements alone will create about 400 to 500 job openings annually. This is a relatively small field of work and there will be no more than about 1,000 to 2,000 job openings for new workers to enter this field annually in the 1956–66 decade.

Earnings and Working Conditions

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for asbestos and insulating workers in the 52 large cities surveyed was $3.29. (Wage rates for this trade may vary within the same city depending upon the work performed and the working conditions.) Among the individual cities, the minimum union hourly wage rates ranged from $2.25 in Philadelphia to $3.85 in New York, as shown in the following tabulation:

Atlanta, Ga	$3.00
Baltimore, Md	3.23
Birmingham, Ala	3.15
Boston, Mass	3.17
Buffalo, N. Y	3.15
Charlotte, N. C	2.90
Chicago, Ill	3.35
Cincinnati, Ohio	3.30
Cleveland, Ohio	3.55
Columbus, Ohio	3.32
Dallas, Tex	3.10
Dayton, Ohio	3.24
Denver, Colo	3.25
Des Moines, Iowa	3.08
Detroit, Mich	3.20–3.52
Erie, Pa	----
Grand Rapids, Mich	3.38
Houston, Tex	3.28
Indianapolis, Ind	3.30
Jacksonville, Fla	3.05
Kansas City, Mo	3.20
Knoxville, Tenn	3.05
Little Rock, Ark	3.10
Los Angeles, Calif	3.25
Louisville, Ky	3.23
Memphis, Tenn	3.13
Milwaukee, Wis	3.21
Minneapolis–St. Paul, Minn	3.03
Newark, N. J	2.55–3.50
New Haven, Conn	3.20
New Orleans, La	3.20
New York, N. Y	3.85
Oklahoma City, Okla	3.15
Omaha, Nebr	3.20
Peoria, Ill	3.35
Philadelphia, Pa	2.25–3.48
Pittsburgh, Pa	3.43

Portland, Oreg	$3.25
Providence, R. I	3.15
Richmond, Va	2.93
Rochester, N. Y	3.20
St. Louis, Mo	3.45
Salt Lake City, Utah	3.00
San Antonio, Tex	3.12
San Francisco-Oakland, Calif	3.18
Scranton, Pa	3.10
Seattle, Wash	3.25
Spokane, Wash	3.20
Springfield, Mass	3.08
Syracuse, N. Y	3.18
Toledo, Ohio	3.33
Washington, D. C	3.40

A large proportion of the workers in this trade are members of the International Association of Heat and Frost Insulators and Asbestos Workers. Union-employer contracts covering asbestos workers usually provide health insurance and pension benefits, generally financed entirely by employers.

Where To Go for More Information

A young man who wishes to obtain further information regarding asbestos workers' apprenticeship programs or work opportunities in this trade should apply to an asbestos contractor in his area or to a local of the International Association of Heat and Frost Insulators and Asbestos Workers.

Additional information may be obtained from:

International Association of Heat and Frost Insulators and Asbestos Workers,
1300 Connecticut Ave. NW., Washington 6, D. C.

Mechanical Contractors of America,
30 Rockefeller Plaza, Suite 1843, New York 20, N. Y.

Construction Laborers and Hod Carriers

(D. O. T. 9–32.01)

Nature of Work

Laborers on building construction and other types of construction (such as highways, sewers, water projects, and engineering construction) do work which requires no formal training. Construction laborers are commonly classified as unskilled workers, but this term can be misleading. Their work covers a wide range of requirements; in many of the operations, experience is valuable and in some of them skill is necessary. Some types of construction laborer and hod carrier jobs often require experience as well as a broad knowledge of construction methods, materials, and operations. One type of such work which illustrates the proficiency gained by experience is hand excavating for footings, concrete supports, small trenches, and other places where machines cannot be used or are not economical. Anybody can dig a hole for a footing, but without experience a person will have considerable difficulty in digging it to the proper dimensions and in getting a firm and level base.

Rock drilling is another type of work in which "know-how" is important. In order to set the blasting charge properly, the laborer must have a knowledge of the different rock strata and considerable experience in handling dangerous explosives.

In the construction of tunnels and caisson foundations, construction laborers must have specific on-the-job experience. They do all the work back of the air lock, including operations which would be done by journeymen if the job were located elsewhere.

Among the principal types of work done by construction laborers are shoveling and grading of earth and carrying materials to the location where they are needed, by hand or by wheelbarrow. Laborers may also move the smaller units of machinery and equipment. They often set bracings and supports in place at the sides of excavations to prevent the collapse of trenches. Where concrete is mixed at the job, they fill the mixer with ingredients and, if already mixed, even help pour the concrete, spread it, and spade it, to prevent air pockets. They do the general cleaning up of rubble at successive stages in construction. In alteration and modernization work, they tear out the old work. In concrete highway paving, laborers handle and place the forms for the concrete, set up and move the hose to supply the concrete mixer with water, and cover new pavement to prevent excessive drying during the "curing" period. Laborers usually form a much larger part of the crew in nonbuilding than in building construction.

Bricklayers' helpers and plasterers' tenders, both commonly known as hod carriers, serve journeymen in their respective trades, supplying them with materials, setting up and moving portable scaffolding, and providing the other services needed by these journeymen. The duties of hod

carriers require familiarity with the work of the journeymen, some knowledge of the materials used, and some degree of judgment. It is customary practice in the building trades for hod carriers to be transferred, along with the journeymen helpers, from one construction project to another.

Where Employed

Laborers and hod carriers are employed primarily by all types of construction contractors on almost every kind of building, road, and engineering project. A large number of these workers are also employed by State and municipal public works and highway departments and by public utility companies in road repairing, maintenance-of-way work, and excavating.

The more than 700,000 construction laborers and hod carriers at work in mid-1956 were employed in every section of the country. The employment of these workers is distributed geographically in much the same way as building trades employment generally (see p. 227).

Training and Other Qualifications

No formal training is required to obtain a job as a construction laborer. Generally, to be employed as a construction laborer, a young man must be at least 16 years of age and in good physical condition. A laborer's first job is usually on the simplest type of work, but as he gains experience he does more difficult work. Although laborers work with skilled building craftsmen, they rarely have a chance to work with the journeyman's tools or equipment and, therefore, generally have no real opportunity to pick up the skills of a building trade.

Employment Outlook

Continued increase in employment for construction laborers is expected during the late 1950's and the 1960's as a result of the anticipated growth in the volume of construction activity. (See discussion, p. 227.) However, increased mechanization and improved methods of materials handling will limit the rate of growth in the employment of these workers. For example, the employment of laborers is being affected by the increasing use and the development of new types of more efficient grading machinery and mechanical lifting devices and by the wider use of easily assembled metal scaffolding.

A more rapid increase in employment of laborers is expected in highway construction than in building construction, largely as a result of the multibillion dollar Federal highway program.

Earnings and Working Conditions

The average hourly wage rates for construction laborers and bricklayers' tenders are generally higher than those for unskilled or semiskilled production workers in manufacturing. However, because of the seasonal nature of much of construction work and because of worktime lost for other reasons, the average annual earnings of laborers and bricklayers' tenders are not as high as their hourly rates of pay would indicate.

The U. S. Department of Labor's Bureau of Labor Statistics' annual survey of union minimum hourly wage rates in the building trades showed that, as of July 1, 1956, the average union hourly rate for building laborers in the 52 large cities surveyed was \$2.20, and \$2.48 for bricklayers' tenders. (Wage rates for laborers and bricklayers' tenders may vary within the same city depending upon the type of work performed and the working conditions.) Among the individual cities, the minimum union hourly wage rates ranged from \$1.15 for building laborers and \$1.25 for bricklayers' tenders in Jacksonville to \$3 for building laborers in Newark and \$3 for bricklayers' tenders in Newark and New York, as shown in the following tabulation:

	Bricklayers' tenders	*Building laborers*
Atlanta, Ga	\$1. 45–1. 57	\$1. 45
Baltimore, Md	1. 95	1. 80
Birmingham, Ala	1. 50–1. 60	1. 50
Boston, Mass	2. 30	2. 30
Buffalo, N. Y	2. 49	2. 49
Charlotte, N. C	1. 28–1. 38	1. 28
Chicago, Ill	2. 58	2. 58
Cincinnati, Ohio	2. 55	2. 35
Cleveland, Ohio	2. 83	2. 83
Columbus, Ohio	2. 30	2. 10
Dallas, Tex	1. 70	1. 55
Dayton, Ohio	2. 53	2. 26
Denver, Colo	2. 43	2. 00
Des Moines, Iowa	2. 25–2. 35	2. 25
Detroit, Mich	2. 55–2. 63	2. 45
Erie, Pa	2. 35–2. 45	2. 25
Grand Rapids, Mich	2. 10–2. 20	2. 10
Houston, Tex	1. 93	1. 75
Indianapolis, Ind	2. 37	2. 20–2. 35
Jacksonville, Fla	1. 25–1. 30	1. 15
Kansas City, Mo	2. 35	2. 16
Knoxville, Tenn	----	1. 63
Little Rock, Ark	1. 50	1. 25

	Bricklayers' tenders	Building laborers
Los Angeles, Calif	$2.63	$2.30
Louisville, Ky	2.38	2.00
Memphis, Tenn	1.75	1.40
Milwaukee, Wis	2.49	2.38
Minneapolis–St. Paul, Minn	2.25–2.38	2.25
Newark, N. J	3.00	3.00
New Haven, Conn	2.35	2.35
New Orleans, La	1.63–1.73	1.53
New York, N. Y	3.00	2.60–2.90
Oklahoma City, Okla	1.95	1.80
Omaha, Nebr	2.00–2.20	2.00
Peoria, Ill	2.53	2.53
Philadelphia, Pa	2.10	1.88–2.10
Pittsburgh, Pa	2.50	2.25
Portland, Oreg	2.65	2.25
Providence, R. I	2.08	2.08
Richmond, Va	1.55	1.40
Rochester, N. Y	2.49	2.49
St. Louis, Mo	2.75	2.05–2.30
Salt Lake City, Utah	2.40	1.98
San Antonio, Tex	1.48	1.38
San Francisco–Oakland, Calif	2.85–2.90	2.33
Scranton, Pa	2.18	2.03
Seattle, Wash	2.67	2.37
Spokane, Wash	2.62	2.27
Springfield, Mass	2.35	2.08
Syracuse, N. Y	----	2.28
Toledo, Ohio	2.65	2.52
Washington, D. C	----	1.87–2.10

The work of construction laborers and hod carriers is generally physically strenuous and requires bending, stooping, and heavy lifting. Much of the work is performed outdoors. Many laborers and hod carriers are members of the International Hod Carriers', Building and Common Laborers' Union of America.

Where To Go for More Information

A young man who wishes to obtain further information regarding work opportunities as a laborer or hod carrier should contact a construction contractor in his area, or a local of the International Hod Carriers', Building and Common Laborers' Union of America, if there is one in his area. In addition, the local office of the State employment service is a source of information and a contact point for such work opportunities.

Additional information may be obtained from:

Associated General Contractors of America, Inc.,
1329 E St. NW., Washington 4, D. C.

International Hod Carriers', Building and Common Laborers' Union of America,
821 15th St. NW., Washington 5, D. C.

PRINTING OCCUPATIONS

The Printing Industry and Its Workers

Printing is an art and one of our chief means of communication. It is also the foundation of one of the country's largest manufacturing industries. In 1956, the Nation's more than 32,000 printing establishments employed more than 850,000 workers and produced a great variety of printed materials valued at more than $10 billion.

The printing industry is an especially large employer of skilled workers. In mid-1956, it employed 270,000 workers in the unique printing crafts—compositors, pressmen, photoengravers, stereotypers, electrotypers, lithographic workers, and bookbinders. These printing crafts make up one of the largest fields of employment for skilled workers in the United States. In addition to those printing craftsmen employed in the printing industry itself, about 50,000 were employed by Government agencies or by businesses doing their own commercial type printing—thus making a total of 320,000 of these craftsmen in mid-1956. (This section of the Handbook deals primarily with these skilled printing occupations. Other occupations found in the printing industry are covered elsewhere in this Handbook.)

The printing trades offer especially good opportunities for young men willing to spend several years in learning a skilled craft. Skilled printing workers generally have year-round employment and much better than average earnings. Jobs are to be found throughout the country, in small towns as well as big cities. Some printing craftsmen also have opportunities to go into business for themselves.

Nature and Location of the Industry

The printing industry may be divided into a number of segments based on the type of product produced. The largest, in terms of the number of jobs provided for printing craftsmen, is made up of the more than 12,000 commercial or job shops which produce such printed matter as letterheads, business forms, posters, displays, and calendars. Commercial plants may also print books, periodicals, newspapers, and pamphlets on contract for other printing firms. Most job shops are small, employing fewer than 10 workers, mainly skilled journeymen. A number of commercial printing plants, however, employ more than a thousand workers each and compete for business on a State or national basis.

Newspapers provide the second largest employment field for printing craftsmen. A great majority of the approximately 1,800 daily and 9,000 weekly newspapers throughout the Nation do their own printing. Although some major metropolitan newspapers employ as many as several hundred skilled craftsmen, many smaller dailies and weeklies employ fewer than 15 skilled workers.

The third largest field of employment for skilled craftsmen is the lithographic segment of the industry. Lithographic plants produce items similar to those of commercial letterpress plants, but differ in the type of printing method used.

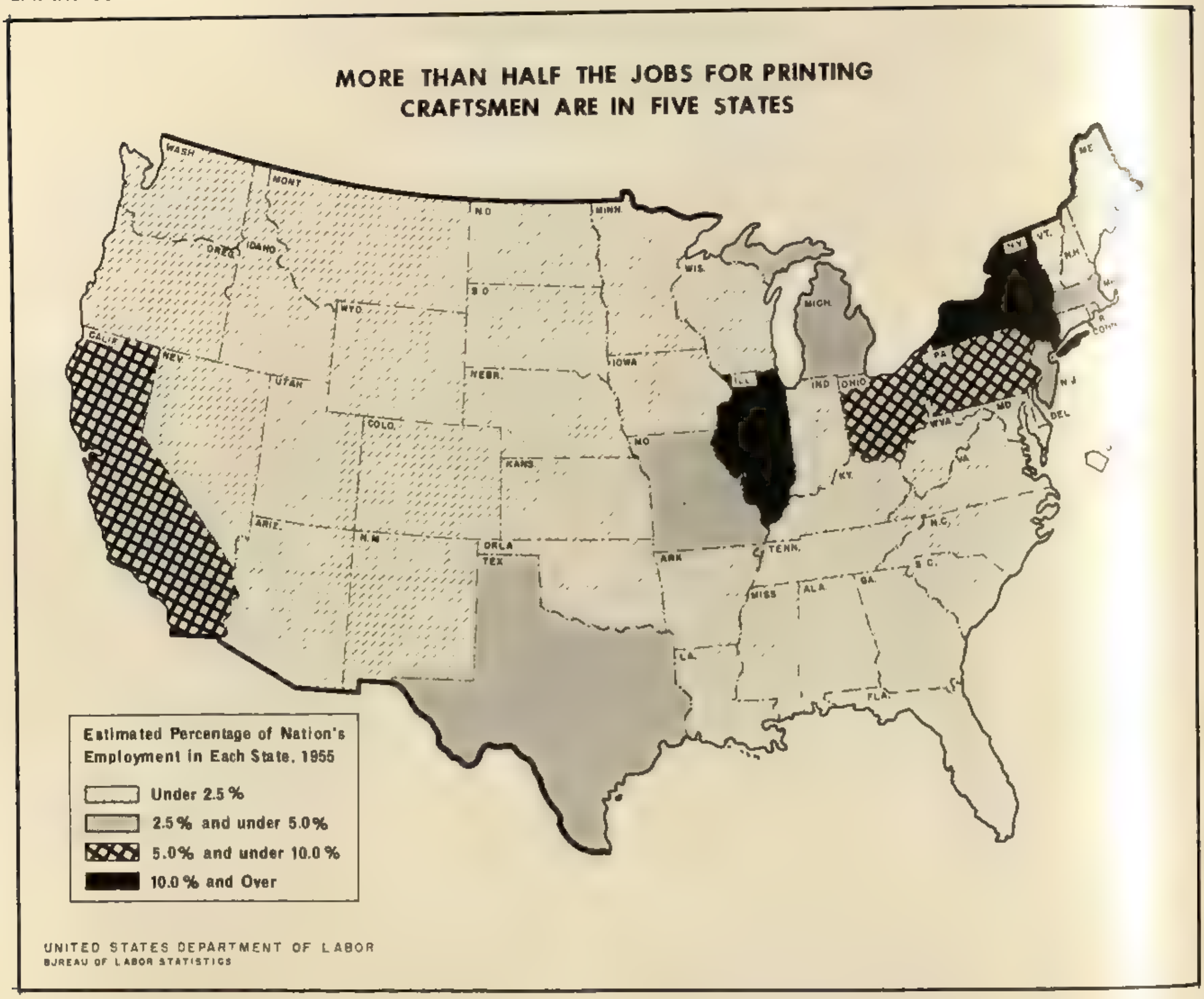
Bookbinding establishments, which assemble printed materials into book or magazines and pamphlets, also provide many jobs for skilled craftsmen.

Other segments of the printing industry employing these craftsmen include firms publishing books or periodicals or manufacturing greeting cards. In addition, many shops perform specialized functions, such as type composition, engraving, photoengraving, stereotyping, and electrotyping on a contract basis for other printing firms.

Many printing craftsmen are also employed by Government agencies and libraries, and by manufacturers and other firms doing some printing in connection with their operations. One example is canned goods producers who print their own labels. One of the largest general printing plants in the country is the U. S. Government Printing Office in Washington, D. C.

More than half of the Nation's printing jobs are in five States—New York, Illinois, Pennsylvania, Ohio, and California. (See chart 38.) Within these States, printing activities are located in areas with heavy concentrations of manufacturing, commercial, or financial activity in or near such large cities as New York City, Chicago, Phila-

CHART 38



delphia, Cincinnati, Cleveland, Los Angeles, and San Francisco. Other leading printing centers are Boston, Newark, Detroit, St. Louis, Minneapolis–St. Paul, Milwaukee, and Washington, D. C. Job and periodical printing is highly concentrated in these major urban areas. A much larger proportion of jobs in newspaper plants is found outside these centers because of the great number of small local newspapers scattered throughout the country. Almost every small town has a printing shop of some kind—frequently, a small newspaper plant which may also handle the community's job printing.

Printing Processes

A description of the various printing processes is essential to an understanding of the duties and qualifications of the printing crafts. Printing is essentially a means of transferring ink impressions of letters, designs, and illustrations to paper, metal, or other material. Printing is done from a master surface, usually metal, called a press plate. There are three basic printing processes in general use today—letterpress, lithography (offset printing), and gravure. A fourth method, silk screen (stencil printing), although less extensively used than the other three methods, is increasing in importance. Each method of reproduction has its own special advantages and requires different types of skilled craftsmen.

In letterpress (also known as relief) printing, the letters and designs to be reproduced are raised above the nonprinting areas of the type or the press plate. When the actual printing is done, ink is applied only to the letters and illustrations,

usually by means of an inking roller. Letterpress is the oldest and by far the most common printing process. Practically all newspapers, the bulk of books, magazines, and most other printed items are produced by this method. Photoengraving (chiefly making plates for use in relief printing of illustrations and other copy that cannot be set up in type) and stereotyping and electrotyping (mainly producing metal and plastic duplicates of type forms and photoengravings for use as press plates) are also part of the letterpress printing process.

The press plate used in lithography (offset printing) is smooth or nearly so, with both the image and nonimage areas on the same level, instead of on different levels, as in letterpress and gravure processes. Lithography makes use of the principle that grease and water repel each other. The image areas of the plate are coated with a greasy substance to which the greasy printing ink will stick. On the press, before each inking, the plate is moistened with water, with the result that only the image areas take up the greasy ink from the inking roller. In modern lithography, the plates are produced photomechanically, and the method is often referred to as photolithography. In a few types of work—preparing posters, for example—some of the plates are still made by hand. Practically all items printed by the letterpress process can also be produced by lithography including books, labels, office forms, and even newspapers. However, lithography is used almost exclusively for calendars, maps, posters, and printing on metal and rough paper.

Intaglio (or gravure) work is less widely used than either the letterpress or lithographic method. In this process, the relative position of the printing and nonprinting areas of the plate is the reverse of that in letterpress. The letters and designs to be printed are cut or etched into the plate and are below the nonprinting surface. Ink is applied to the entire plate, but the surface is then wiped or scraped, leaving ink only in the depressions. In printing, suction is created, which lifts the ink out onto the paper. Intaglio printing is of two main types: Rotogravure (in which press plates are made from pictures and type by a method based on the photography), and hand or machine engraving. The picture supplements of some Sunday newspapers are the best known rotogravure items. Rotogravure pictures also appear in many magazines and in other forms of printed material as well. Some printing on metal foil is done by this means. Hand or machine engraving is used in making engraved stationery, greeting cards, paper money, bonds, and similar products.

Printing Occupations

Regardless of the process employed, most printing jobs go through at least three phases: composition, platemaking, and presswork. (See chart 39.) Additional processing in a bindery is also needed for products that must be bound, such as books and magazines. In the past, many all-round printers could perform every printing operation. Such craftsmen are still found in small newspaper and job shops. Today, however, printing craftsmen are usually more specialized and their training is directed to a broad area of printing operations—for example, type composition or presswork. They may specialize even further—for example, operating a linotype in a composing room. Training, moreover, is largely confined to only one of the basic printing methods.

The relative number of workers employed in the principal printing occupations is shown in chart 40. Composing room workers include hand compositors and typesetters, linotype operators, monotype keyboard operators, monotype caster operators, teletypesetters, photocompositors, and proofreaders, and make up the largest single group of printing craftsmen, with about 175,000 workers employed in mid-1956. The second largest group of skilled printing workers is the pressmen and plate printers, about 55,000 of whom were employed in mid-1956. Other important occupations are electrotypers and stereotypers, photoengravers, bookbinders, and lithographic workers. (The above occupations are described in detail later in this chapter of the Handbook.)

Many other groups of skilled workers are employed in printing plants. Among these are mechanics who are employed in the larger plants to repair and adjust typesetting machines, printing presses, or bindery equipment. There are also several thousand machinists who make metal parts or fixtures for printing equipment. Steel and copper plate engravers, who cut or etch lettering

CHART 39

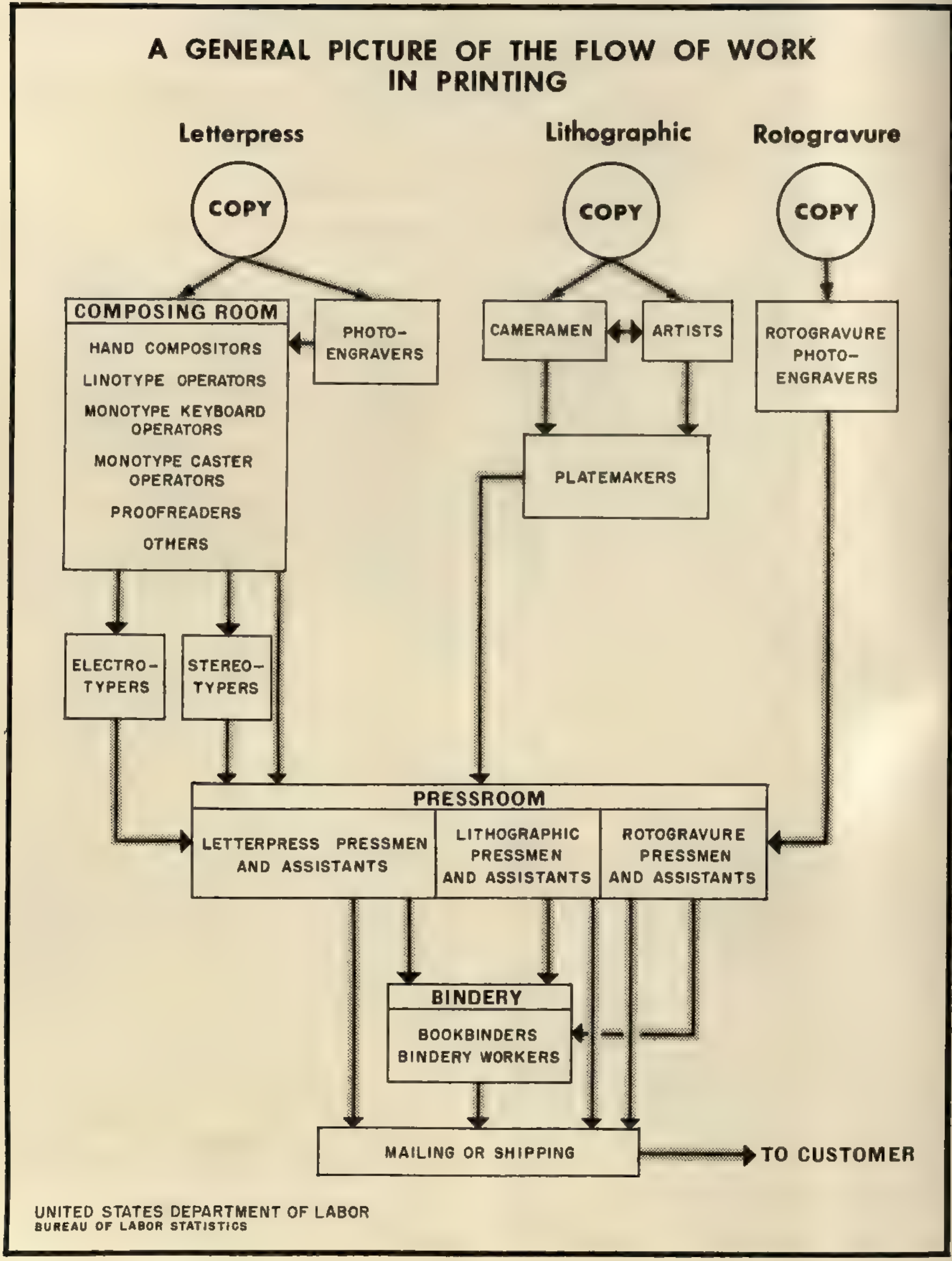
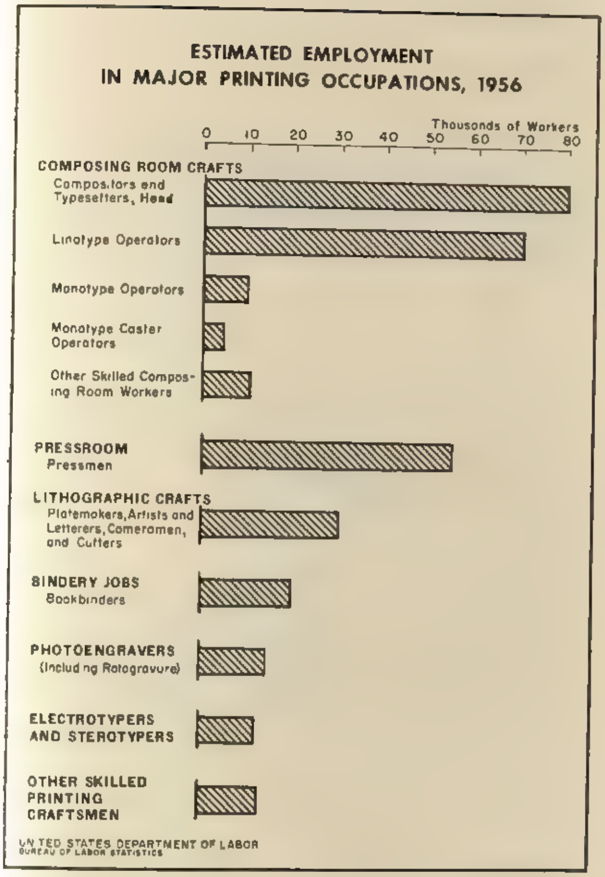

A GENERAL PICTURE OF THE FLOW OF WORK IN PRINTING
Letterpress
Lithographic
Rotogravure
COPY
COPY
COPY
COMPOSING ROOM
HAND COMPOSITORS
LINOTYPE OPERATORS
MONOTYPE KEYBOARD OPERATORS
MONOTYPE CASTER OPERATORS
PROOFREADERS
OTHERS
PHOTO-ENGRAVERS
CAMERAMEN
ARTISTS
ROTOGRAVURE PHOTO-ENGRAVERS
PLATEMAKERS
ELECTRO-TYPERS
STEREO-TYPERS
PRESSROOM
LETTERPRESS PRESSMEN AND ASSISTANTS
LITHOGRAPHIC PRESSMEN AND ASSISTANTS
ROTOGRAVURE PRESSMEN AND ASSISTANTS
BINDERY
BOOKBINDERS
BINDERY WORKERS
MAILING OR SHIPPING
TO CUSTOMER
UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

CHART 40



and designs into plates by hand or machine, are employed in numerous small engraving shops.

In the skilled occupations, practically all the workers are men. However, many of the less skilled workers, especially in binderies, are women. A small but growing number of Negroes are employed in skilled jobs; a greater number in the less skilled occupations. In the several hundred shops which print newspapers, magazines, or other items mainly for the Negro community, the great majority of workers in all types of jobs are Negroes.

Printing establishments employ a great many other persons in addition to skilled craftsmen. Included among these are executives, estimators, salesmen, stenographers, clerks, and laborers of various types. The duties of these employees are similar to those of comparable personnel in other industries, and are discussed elsewhere in this Handbook. (See index.) Newspapers and other publishers employ a considerable number of reporters and editors. These occupations are discussed in another chapter of this Handbook (see p. 185).

Training and Other Qualifications

The most common way of entering a skilled printing occupation is through apprenticeship. With rare exceptions, it is the only means by which one may be trained to become a journeyman in a union shop. Formal apprenticeship is also required for journeyman status in many of the larger establishments not covered by union contracts. In some of the smaller shops, however, it is possible to pick up the printing trades by working with the printing craftsmen or by a combination of work experience and schooling.

Printing apprenticeships usually last from 4 to 6 years, depending on the occupation and the shop or area practices. The training program covers all phases of the particular trade and almost always includes classroom or correspondence study in related technical subjects as well as training on the job. (Examples of the training schedule for apprenticeships in the various printing crafts are included with the detailed discussion of these crafts later in this chapter of the Handbook.) To be eligible for apprenticeship, applicants are generally required to be at least 18 (sometimes only 16) and not over 30 years of age. Applicants are generally required to take a physical examination and appropriate aptitude tests.

In selecting applicants for apprenticeship, most employers require a high school education or its equivalent. A thorough knowledge of spelling, punctuation, and grammar is essential for some of the printing trades. Courses in art, such as drawing, design, color, and lettering, as well as courses in physics and chemistry, are also helpful for many kinds of printing work. About 3,000 vocational or high schools offer courses in printing. These courses may materially help a young person seeking a printing career in obtaining an apprenticeship in the field. Mechanical aptitudes and a genuine interest in the work are essential for some printing trades. Apprentices are often chosen from among the young men already employed in various unskilled jobs in printing establishments.

Employment Outlook

Continued increase in the number of workers employed in the skilled printing trades is expected during the late 1950's and the 1960's. This growth, however, is expected to be somewhat

slower than the increase in the Nation's total labor force. In addition to the job opportunities resulting from the growth of these trades, replacement needs will provide a considerable number of openings for new workers each year.

Employment in the printing industry since the beginning of the century has shown a generally steady but slow growth except for the depression years and the war years. The trend of employment in the industry has generally followed the growth of the economy, but has increased at a somewhat slower rate. One of the sharpest gains in printing employment has occurred in the post-World War II period. From 1946 to 1955, total employment in the printing industry increased by about 25 percent. However, the number of production workers (which include printing craftsmen) increased about 16 percent.

A continued rise in the volume of printing material produced is anticipated as a result of population growth and the expansion of the American economy as well as the tendency toward relatively greater use of printed material for information, advertising, and various industrial and commercial purposes. However, as in the past, employment in the printing trades is not expected to rise as much as the increase in the output of printed matter.

A number of technological developments now taking place in the industry may greatly affect printing methods and the number and kinds of printing workers employed. Among these are developments in photocomposition; phototypesetting machines; electronic printing and engraving; magnesium, bimetal, and trimetal lithographic printing plates; and color scanners. Most of these developments are in the area of type composition and platemaking. The silk screen process, which involves different skills, has been gaining in popularity and competes with offset in doing certain kinds of printing, especially color display advertising. Research is being expanded in several other printing processes, particularly those involving electronic or magnetic principles. However, it must be pointed out that as new technological developments have been introduced into the industry and have been incorporated in the duties of the traditional printing crafts, the resulting new techniques have been included in the apprenticeship training.

As in the past, there will be differences in the rate of growth among the various printing crafts. Little increase is expected in the number of skilled composing room workers, the largest group of printing craftsmen. These occupations are most likely to be affected by changes in printing equipment and competitive methods. The number of workers in these occupations increased less than 10 percent in the 15-year period 1940 to 1955, compared with a growth of about 46 percent in employment in the entire printing industry in the same period. The largest proportionate job increases can be expected among pressmen and lithographic workers. These groups have also shown the greatest growth since World War II, as indicated in the employment outlook for individual printing crafts discussed at the end of this chapter.

The need to replace workers who die, retire, or transfer to other fields of work will provide many openings for young men in the various printing crafts. Deaths and retirements alone will create about 7,000 or 8,000 job openings each year.

At the beginning of 1957 there were about 14,000 registered apprentices in training. (A registered apprentice is an employee who, under an expressed or implied agreement for a stipulated term, receives instruction in an apprenticeable occupation, and is employed in an apprenticeship program registered with a State apprenticeship agency or the U. S. Department of Labor's Bureau of Apprenticeship.) Also, there were perhaps an additional 8,000 to 10,000 apprentices in programs which were not registered. Furthermore, a substantial number of persons pick up a printing trade while working as helpers, particularly in small shops and in the smaller communities.

Opportunities for young men to receive apprenticeship training will be available in all parts of the country. Perhaps some indication of the location of future apprenticeship opportunities may be obtained by examining the present geographical distribution of registered apprentices. It must be borne in mind that registration is voluntary and that in some localities many employers, for one reason or another, have not registered their apprenticeship programs. The following table shows the number of registered apprentices in training for selected printing trades, by State, as of January 1, 1956:

State	*No. of apprentices*
Total	14, 159
Alabama	54
Arizona	65
Arkansas	35
California	1, 068
Colorado	91
Connecticut	652
Delaware	31
District of Columbia	426
Florida	106
Georgia	53
Idaho	7
Illinois	327
Indiana	274
Iowa	350
Kansas	105
Kentucky	244
Louisiana	113
Maine	35
Maryland	140
Massachusetts	605
Michigan	708
Minnesota	697
Mississippi	-----
Missouri	244
Montana	65
Nebraska	116
Nevada	9
New Hampshire	11
New Jersey	263
New Mexico	26
New York	2, 988
North Carolina	324
North Dakota	2
Ohio	1, 471
Oklahoma	29
Oregon	123
Pennsylvania	727
Rhode Island	47
South Carolina	95
South Dakota	-----
Tennessee	94
Texas	385
Utah	22
Vermont	76
Virginia	255
Washington	166
West Virginia	80
Wisconsin	355
Wyoming	-----

Earnings and Working Conditions

Earnings in the printing and publishing industry range near the top among all manufacturing industries. In December 1956, production workers in this industry (including semiskilled and unskilled workers in addition to the printing craftsmen) averaged $96.19 a week and $2.46 an hour. This compares with the average for production workers in all manufacturing industries of $84.05 a week and $2.05 an hour in the same month.

What an individual printing craftsman can expect to earn varies from one occupation to another. Generally, the wage rates in larger cities are higher than in smaller communities. Wage rates also differ by type of printing establishment. The best sources of information on basic pay rates in the printing trades are the union wage rates for selected occupations in important printing centers reported annually to the U. S. Department of Labor's Bureau of Labor Statistics. The union rates are the minimum basic rates for the given occupational classifications. They do not include overtime, other special payments, or bonuses. A table showing these wage rates in the important printing centers for each occupation is presented in the discussions of the individual occupations. The following are the average minimum union hourly wage rates (individual rates are weighted by the number of union employees reported at each rate) for selected occupations in 53 cities of 100,000 or more population in July 1956:

Printing trade	Average minimum hourly rate, July 1956	
	Newspaper	Book and job
Bookbinders	----------	$2. 71
Compositors, hand	$3. 12	2. 96
Electrotypers	----------	3. 20
Photoengravers	3. 41	3. 45
Pressmen (journeymen)	3. 14	----------
Pressmen (cylinder)	----------	2. 96
Pressmen (platen)	----------	2. 66
Stereotypers	3. 09	3. 20

A standard workweek of 37½ hours was specified in labor-management contracts covering a majority of the organized printing trades workers. Work on Sundays and holidays is customarily paid for at time and a half or double-time rates in most printing establishments. Night-shift workers generally receive pay differentials above the standard day rates. In newspaper plants, an individual employee's workweek often must include Sundays. Time and a half or double

time is paid for these days only when they are not part of the employee's regular shift.

The starting rate of an apprentice is generally from 30 to 50 percent of the basic wage rate for journeymen in the shop. This is increased periodically, usually every 6 months, until in the final year or half year of training, the apprentice receives from 80 to 95 percent of the journeyman rate. Apprentices with prior experience, civilian or military, or in exceptional cases, technical school training, can obtain credit which will start them above the beginning apprentice pay rate and also reduce the length of time required to become journeymen.

The amount printing craftsmen can earn during a year depends not only on their rate of pay, but also on regularity of employment. The printing industry has less seasonal fluctuation than most other manufacturing industries and thus offers steadier employment to its workers.

Paid vacations are typical in the industry. The most common provision is 2 weeks' vacation with pay after 1 year's employment. Such major benefit plans as retirement funds, life and disability insurance, hospitalization, and severance pay are also common in the industry. In addition, a number of printing trade unions have for many years operated their own programs providing their members with one or more types of benefits, such as life insurance, retirement, sickness, or disability payments.

The accident-frequency rate in the printing industry is lower than the average for all manufacturing industries. In 1956, the injury-frequency rate was 9.2 disabling work injuries per million man-hours worked in printing and publishing, compared with the average of 11.9 for all manufacturing industries.

A large proportion of the skilled workers in the industry are members of unions affiliated with the AFL–CIO. The two largest unions are the International Typographical Union, and the International Printing Pressmen and Assistants' Union of North America. Other unions include the International Photo-Engravers' Union of North America, International Stereotypers' and Electrotypers' Union, and International Brotherhood of Bookbinders. Their names indicate the crafts included in their membership. The majority of lithographic workers are in plants under contract with the Amalgamated Lithographers of America, a union which organizes on a plant-wide basis, and, therefore, includes other workers as well as skilled craftsmen.

Where To Go for More Information

Information on opportunities for apprenticeship or other types of printing employment in a particular locality may be obtained from various sources. Applicants may apply directly to the printing establishments in their areas. The names and locations of local printers can usually be obtained from the classified section of the local telephone directory. In addition, the local unions and employer associations can often provide information regarding apprenticeship openings. In union shops, many apprenticeship programs are supervised by joint union-management committees. In these plants, applicants for apprenticeship may apply directly to the coordinator of the joint apprenticeship committee if there is one in their locality. In recent years there has been a trend toward increased use of local officers of the State employment services as contact points for apprenticeship openings. Some local employment service offices provide such services as screening applicants and giving aptitude tests. However, the final selection is made by the employer, the joint apprenticeship committee, or the union.

For general information on the printing industry, applicants may write to the following organizations. (See sections on individual printing occupations for names of labor organizations and trade associations which can provide more information on specific printing trades.)

American Newspaper Publishers Association,
370 Lexington Ave., New York 17, N. Y.

Book Manufacturers Institute, Inc.,
25 West 43d St., New York 18, N. Y.

Education Council of the Graphic Arts Industry,
5728 Connecticut Ave. NW., Washington 15, D. C.

National Association of Magazine Publishers,
232 Madison Ave., New York 16, N. Y.

Printing Industry of America, Inc.,
5728 Connecticut Ave. NW., Washington 15, D. C.

Composing Room Occupations

Printing by the letterpress process begins in the composing room. It is here that the manuscript copy is set in type, chiefly by typesetting machines, but also by hand. In the composing room, hand and machine-set type, photoengraving cuts, and other material necessary for the completed printing jobs are also assembled and made ready for the pressroom.

In mid-1956, about 175,000 skilled workers, more than half of all printing craftsmen, were employed in composing room occupations. These occupations offer good opportunities for young men willing to spend several years in learning a skilled craft. Usually workers in these occupations have year-round employment and better than average earnings. The two principal composing room occupations are hand compositors and linotype or intertype machine operators. Others include monotype keyboard operators, monotype caster operators, teletypesetters, and proofreaders. A new group of composing room occupations, usually described by the general term "photocomposition," may become more important in the future, particularly in commercial printing establishments and trade composition shops.

Students learning basic hand composition and typesetting operations at printing trade school.

Skilled composing room craftsmen are employed in all branches of the printing industry—newspaper plants, commercial printing shops, and periodical and book printing establishments, as well as trade shops, which do type composition for other printing concerns. They work throughout the country in almost every community of any size. Employment, however, is concentrated in the larger commercial and industrial cities, such as New York City, Chicago, Philadelphia, Los Angeles, Boston, Washington, D. C., San Francisco, Detroit, St. Louis, Baltimore, and Cleveland.

Nature of Work

Hand Compositors and Typesetters (D. O. T. 4-44.010). The oldest and largest composing room occupation is that of the hand compositor. In mid-1956, about 80,000 skilled workers were employed in this trade. An important function of workers in this occupation is to set type by hand for the printing of short articles, advertisements, and for other jobs of limited length that are impractical to set by machine. After final printing on the presses, hand compositors also break down the type forms and distribute the foundry type back to the proper storage compartments for reuse. A principal duty of these workers is to assemble all the materials necessary for the completed job by arranging machine-set as well as hand-set type and any needed engravings into pages. They then lock the completed pages into forms preparatory to sending them to the pressroom, or the stereotyping or electrotyping foundry, or before having proofs made for processing into printing surfaces by offset or gravure. In large plants, workers may specialize in a particular operation, such as "page makeup."

In setting type by hand, the hand compositors, reading from the manuscript copy, set each line of type in a "composing stick" (a device which holds type in place)—letter by letter and line by line.

When this stick is full they slide the completed lines onto a shallow metal tray called a "galley."

Linotype Operator (*D. O. T. 4-44.110*). The second principal composing room occupation is that of linotype operator (or intertype operator). About 70,000 workers were employed in this craft in mid-1956. These craftsmen operate semiautomatic machines which set the type much more rapidly than can the hand compositors. Nearly all printing plants where a large amount of type composition is needed, such as newspaper plants or large commercial shops, use these machines and operators to set type.

In setting type, the operators, reading from copy clipped to the machine's copy board, select the letters and other characters by operating a keyboard somewhat similar to a typewriter, which has about 90 keys. As they press the keys, the letters, in forms of metal molds or "matrices," are assembled into words and lines. After they complete each line, the operators work a lever and the machine automatically casts the line of type in a solid strip of metal called a "slug." The slugs are then deposited in a galley and later assembled into type forms from which either the printing impressions or plates are made. In the smaller plants, the linotype operators maintain and repair, as well as operate, the linotype machines. In the larger shops however, mechanics are employed to make all but minor adjustments to the machines.

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Linotype operator at keyboard of linotype machine.

Monotype Keyboard Operators (*D. O. T. 4-44.120*). About 10,000 workers were employed in mid-1956 as monotype keyboard operators. These workers operate a machine which has a keyboard somewhat similar to a typewriter, but includes about four times as many keys. Unlike the linotype, which does the entire typesetting job, the monotype keyboard produces only a perforated paper roll which is later fed into a monotype casting machine which casts and assembles type automatically. (See the following description of monotype caster operators.) In contrast to the linotype, the monotype makes possible the automatic casting of individual letters and other characters. This permits corrections to be made by hand without the need of resetting the entire line. Monotype thus retains some of the flexibility of hand composition while offering the speed of machine operation.

Monotype Caster Operators (*D. O. T. 6-44.310*). Workers in this occupation operate the monotype casting machines referred to above. These machines cast and assemble type automatically, guided by the perforations in the rolls of the paper prepared by the monotype keyboard operators. New type is made for every job. The roll of paper is fed into the monotype casting machines and the proper dies for casting the letter is automatically selected by means of the perforations on the tape. Molten type metal is forced into the die or matrix to form the individual letters. The principal duties of these workers are to set up the machine, tend it while it is operating, and do the necessary maintenance and repair work. Only 1 caster operator is employed to every 2 or 3 keyboard operators. The types of plants employing monotype caster operators are the same as for keyboard operators—chiefly book and periodical houses.

Training and Other Qualifications

Apprenticeship is the principal way to become a hand compositor, especially in union shops. Many compositors and typesetters, however, have

learned their skills while working as helpers for several years (particularly in small shops and in the smaller communities) or through a combination of trade school and helper experience.

Generally, apprenticeship training for compositors and typesetters covers a 6-year period of progressively advanced training, supplemented by classroom instruction or correspondence courses. However, this period may be shortened by as much as 2 years for apprentices who have had previous experience or schooling or who have shown the ability to learn the trade more rapidly. The time and emphasis spent upon any particular phase of training varies from plant to plant, depending upon the type of printing establishment. The following tabulation is an example of a work training apprenticeship schedule for compositors:

Type of work	*Approximate hours*
Total	12,000
General orientation (stocking, cleaning, and storage of type, etc.)	3,000
Elementary hand composition (proofing, making corrections, elementary typography etc.)	2,800
Use of composing room tools (saws, trimmer, miterer, etc.)	500
Makeup (arrangement of type and engravings into pages, etc.)	1,200
Lockup imposition and lineup (spacing and arrangement of pages preparatory to pressroom, etc.)	500
Specialized work (after the apprentice has completed his preliminary training, he continues on to more intensive training in one or more specialized fields such as (a) hand composition; (b) monotype keyboard operation; (c) monotype caster operation; (d) intertype operation; (e) phototypesetting machines; (f) teletypesetting machines; and (g) photocomposition techniques	4,000

To be eligible for apprenticeship, an applicant must be in good physical condition, at least 16 years old, and usually a high school graduate. Applicants are often given aptitude tests. Employers stress English and mathematics as important qualifications. Training in printing in vocational or high schools is good preparation for apprentices. Imagination and artistic ability are assets which may be helpful to a compositor in layout work. Apprentices are often selected from young men already employed in unskilled jobs in printing shops.

Apprentices are paid according to a predetermined wage rate. The wage progression rate varies among localities. The following example illustrates an apprentice's wage schedule based upon specified percentages of a journeyman's rates:

Period	*Percent*
1st 6 months	40
2d 6 months	45
3d 6 months	50
4th 6 months	55
5th 6 months	60
6th 6 months	65
7th 6 months	70
8th 6 months	75
9th 6 months	80
10th 6 months	85
11th 6 months	90
12th 6 months	95

Employment Outlook

There will be many opportunities for young men to enter the skilled composing room occupations during the late 1950's and the 1960's, although the level of employment in these occupations is not expected to increase much during this period. The great majority of job openings will result from replacement needs. Composing room jobs make up a very large occupational field—with about 175,000 skilled workers in mid-1956. Just to replace the skilled workers who die or retire will create about 3,000 to 4,000 job openings each year.

Between 1940 and 1955, employment in the composing room crafts increased very slowly. This is in sharp contrast to the relatively large increase in the volume of printing produced and to the general growth of employment in the printing industry. Although the value of printed products more than doubled and industry employment increased about 46 percent, the number of skilled composing room jobs rose by less than 10 percent. The continued expansion in the volume of printing in the United States during the next 10 or 20 years is expected to result in only a small rise in employment for this group.

A number of technological developments now being introduced may in the future significantly affect the nature of the occupational skills of the composing room as well as the numbers of workers required. One of these is the greater use of photocomposition machines that are faster and easier to operate than the typesetting machines now in use. Another machine, the electrotypesetter, permits automatic typesetting by remote control. From a central point, the same type can be set

simultaneously on typesetting machines in any number of locations. Under this system, it is possible for linotype machines to be operated automatically by means of a tape, and linotype operators would be needed only for such duties as adjusting the machines, making corrections, or setting up small jobs. These machines could thus substantially reduce the number of jobs for linotype operators in newspaper plants or large commercial printing establishments if widely adopted. It appears that the apprentice training programs of composing room craftsmen will include instruction in the operation of these new machines, and thus these skills will become part of the present crafts.

Earnings and Working Conditions

As is true for most printing crafts, earnings of skilled composing room workers are relatively high compared with skilled workers generally. There is, however, considerable variation in the wage rates by geographic area and by type of establishment. The average minimum union wage rate for hand compositors in 53 cities with populations over 100,000 was $3.12 in newspaper plants and $2.96 in book and job shops. Minimum union wage rates for hand compositors ranged from $2.31 an hour in book and job shops in Salt Lake City, Utah, to $3.33 an hour in newspaper plants in Chicago, Ill. Minimum union hourly wage rates in effect on July 1, 1956, for selected cities are shown in the accompanying table.

City	Book and job	Newspaper
Atlanta, Ga	$2. 75	$2. 84
Baltimore, Md	2. 66	3. 06
Boston, Mass	2. 61	3. 06
Buffalo, N. Y	2. 83	3. 07
Chicago, Ill	3. 24	3. 33
Cincinnati, Ohio	2. 83	2. 93
Cleveland, Ohio	2. 95	3. 02
Columbus, Ohio	2. 90	3. 03
Dayton, Ohio	2. 97–3. 06	2. 93
Des Moines, Iowa	2. 74–3. 07	2. 97
Detroit, Mich	3. 15–3. 28	3. 26
Houston, Tex	2. 96	2. 96
Indianapolis, Ind	2. 65	3. 02
Jacksonville, Fla	2. 38	2. 75
Los Angeles, Calif	3. 08	3. 03
Memphis, Tenn	2. 53	2. 93
Milwaukee, Wis	2. 89	2. 99
Minneapolis–St. Paul, Minn	2. 92–2. 95	3. 22–3. 27
Newark, N. J	3. 07	3. 12
New Haven, Conn	2. 61–2. 77	2. 77
New Orleans, La	2. 55	2. 76
New York, N. Y	3. 15	3. 28
Oklahoma City, Okla	2. 50	----------
Philadelphia, Pa	2. 72	2. 99
Pittsburgh, Pa	3. 04	3. 09
St. Louis, Mo	2. 91–3. 01	3. 19
Salt Lake City, Utah	2. 31	2. 92
San Francisco, Calif	3. 09	3. 06
Seattle, Wash	3. 26	3. 31
Washington, D. C	2. 94	3. 26

Working conditions for compositors vary from plant to plant. Generally, the newer plants are well lighted and clean, and many are air conditioned. Composing room jobs do not require exceptional physical strength, but hand composing work does entail standing for long periods of time. Young men with some types of physical handicaps have been able to get into the trade and do the work satisfactorily. There is considerable nightwork for compositors. Employees generally receive additional pay for working the second or third shift.

A large proportion of the compositors and typesetters are members of the International Typographical Union, 1 of the 6 major unions of printing workers.

Where To Go for More Information

International Typographical Union,
2820 North Meridian St., Indianapolis 6, Ind.

See also page 290 for additional sources of information.

Photoengravers

(D. O. T. 4–47.100)

Nature of Work

The photoengraver makes metal printing plates of illustrations and other materials that cannot be set up in type. On these plates the printing surfaces stand out in relief above the nonprinting spaces, as do the letters on the accompanying type. Similarly, rotogravure photoengravers, a special-

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Photoengraver (router) cutting away metal from nonprinting areas of a plate.

ized type of photoengraver, make plates for use in reproducing pictures and type, but these are gravure plates with the image etched below the surface.

In making a photoengraving plate for the letterpress process, the entire job may be done by one man or it may be divided among a number of skilled workers, each specializing in a particular operation. These specialized workers have job titles indicating the type of work performed, such as photographers, printers, etchers, finishers, routers, blockers, or provers. In the large shops, the work is almost always divided among a number of these specialists.

In making photoengraving plates, a *cameraman* starts the process by photographing the material to be reproduced through a cross lined screen which breaks down the copy into a multitude of minute dots. He then develops the negative. Next, the *printer* prints the image on a metal plate. To do this, a metal plate is coated with a sensitized solution and then exposed with a negative to arc lights. The image areas are protected by chemical means so that they will not be etched away with the other areas of the plate when placed in an acid bath by the etcher. The job of the *etcher* is to "cut away" the background areas by means of this acid, leaving the image standing out in relief. A number of other operations are then performed, including finishing (careful inspection and touching up with handtools), etching and re-etching (bringing out the details of the designs and illustrations), routing (cutting away metal from the nonprinting part of the plate to prevent them from touching the inking rollers during printing), blocking (mounting the engraving on a wooden block to make it the right height), and proving (printing a sample copy on a proof press).

The operations done in rotogravure photoengraving are much like those involved in letter press photoengraving except that a positive (instead of a negative) is used in making the plate, and it is the image (rather than the background) areas that are etched away.

More than 15,000 journeymen photoengravers were employed in mid-1956. The great majority of photoengravers are employed in commercial service shops where the main business is making photoengravings for use by others. Many craftsmen have their own shops; however, newspaper and rotogravure shops employ nearly a third of all journeymen. In addition, book and periodical houses, the United States Government Printing Office, and the United States Bureau of Engraving and Printing also employ a considerable number of photoengravers. Jobs are highly concentrated in the largest printing centers, particularly New York City, Chicago, Philadelphia, and Los Angeles.

The 2,000 to 3,000 rotogravure photoengravers employed in mid-1956 worked mainly in independent rotogravure plants. Most of them worked for the small number (perhaps less than 15) of big firms which handle a large proportion of all rotogravure work. A few large newspaper and commercial plants also have departments where rotogravure work is done. Rotogravure plants are concentrated in a few States, particularly New York, New Jersey, Illinois, and Ohio.

Training and Other Qualifications

Apprenticeship is the accepted way to become a photoengraver. The apprenticeship program generally covers a 5- or 6-year period and includes at least 800 hours of related classroom instruction. The following tabulation is an example of a work training apprenticeship schedule for photoengravers (strippers and printers):

Type of work	*No. of months required*
Total	60
Shop organization procedures and policies; Name, care, and proper use of tools, equipment, and materials; General photoengraving work	12
Cutting, squaring, and turning negatives	3
Laying and assembling negatives for combination plates	3
Inspecting negatives for defects	6
Mixing chemicals	6
Sensitizing metal	6
Operating whirling machine	6
Setting up and operating vacuum frame with proper pressure	6
Developing print	6
Burning-in enamel to make print acid resistant	6

To be eligible for apprenticeship training, an applicant must be at least 18 years of age and generally must have a high school education or its equivalent. Courses in chemistry and physics, particularly as they relate to photography and the science of optics, provide a desirable background for the apprentice applicant. Training in art is also very helpful. Credit for previous experience in various photoengraving skills may shorten the required apprenticeship time. Many employers require physical examination for prospective photoengravers, paying particular attention to eyes and lungs, because a photoengraver's duties involve constant close work and color discrimination, as well as working with acid and other chemicals which give off fumes.

Employment Outlook

The anticipated continued expansion in printing output, the greater use of photographs and other illustrations, and the increasing use of color are expected to result in a continued increase in the number of photoengravers during the late 1950's and the 1960's. Technological changes, such as wider use of phototypesetting and more rapid etching techniques may result in more work for photoengravers. Replacement needs will provide some job openings. However, this a a fairly small field with only about 12,500 photoengravers (letterpress) and 2,500 photoengravers (gravure) employed in mid-1956. On the average, the growth in employment and replacement needs together will probably result in not more than 500 to 800 openings for new workers to learn this trade each year.

Earnings and Working Conditions

Photoengravers are among the highest paid printing craftsmen. The average minimum union wage rate for photoengravers, including gravure, in 30 cities with populations over 100,000, ranged from $2.67 in New Orleans in book and job shops to $3.98 in Detroit. The union hourly wage rates in effect on July 1, 1956, for selected cities are shown in the following table:

City	Book and job	Newspaper
Atlanta, Ga.	$3.03–3.08	$3.09
Baltimore, Md.	3.03–3.37	3.28
Boston, Mass.	3.04	3.[illegible]–3.50
Buffalo, N. Y.	2.99	3.33
Chicago, Ill.	3.84–3.87	3.56
Cincinnati, Ohio	3.13	3.15
Cleveland, Ohio	3.28–3.52	3.28
Columbus, Ohio	3.04–3.23	3.31
Dayton, Ohio	3.16	3.12
Des Moines, Iowa	3.12	3.12
Detroit, Mich.	3.20–3.98	3.43
Houston, Tex.	3.13	3.15
Indianapolis, Ind.	3.13	3.16
Jacksonville, Fla.	2.84	2.75
Los Angeles, Calif.	3.49	3.20
Memphis, Tenn.	3.02	3.13
Milwaukee, Wis.	3.26	3.31
Minneapolis–St. Paul, Minn.	2.83–3.69	3.[illegible]–3.25
Newark, N. J.	3.71–3.79	3.50
New Haven, Conn.	2.83	----
New Orleans, La.	2.67	2.83
New York, N. Y.	3.86–3.91	3.53
Oklahoma City, Okla.	2.88	3.10
Philadelphia, Pa.	3.46–3.66	3.23
Pittsburgh, Pa.	3.06–3.40	3.35
St. Louis, Mo.	3.05	3.29
Salt Lake City, Utah	2.80	3.07
San Francisco, Calif.	3.37	3.20
Seattle, Wash.	3.38	3.34
Washington, D. C.	3.14	3.48

The great majority of photoengravers are union members. Nearly all photoengravers are represented by the International Photo-Engravers' Union of North America.

Where To Go for More Information

International Photo-Engravers' Union of North America,
3605 Potomac St., St. Louis 16, Mo.

American Photoengravers Association,
166 West Van Buren St., Chicago 4, Ill.

See also page 290 for additional sources of information.

Electrotypers and Stereotypers

(D. O. T. 4–45.010 and .210)

Nature of Work

Electrotypers and stereotypers make the duplicate press plates for letterpress printing from the metal type form prepared in the composing room. Most volume printing requires the use of duplicate printing plates. When a large edition of a book or magazine is printed, several plates must be used one after the other to replace those which have become too worn to make clear impressions. By means of duplicate plates, printers can also use several presses on the same job, at the same time, and thus finish a big run quickly. This is especially important in publishing daily newspapers, since a plant may have to rush many thousands of papers onto the streets with news that is no more than an hour or two old. Furthermore, the rotary presses used in many big plants require curved plates. These plates can be made by both electrotyping and stereotyping processes from the flat type forms.

To produce a fine metal plate ready for use in the pressroom requires several steps. In electrotyping, the first step is the making of a mold of the type form. A metallic coating is then deposited on the mold by coating it with a copper sulphate or nickel solution in the case of a wax mold, or a film deposit of metallic silver in the case of a plastic mold. The mold is then suspended in an electrolytic solution which leaves a metallic shell deposit on the coated mold. The next step is to strip the metallic shell from the mold. The shell is then backed with metal and carefully finished.

The stereotyping process is much simpler, quicker, and less expensive than electrotyping, but it does not yield as durable or as fine a plate. Stereotypers make molds or mats of papier maché (a strong material composed of paper pulp) instead of wax or plastic. This involves placing the moist mat (in newspaper printing, usually a dry mat) on the type form, then covering it with a cork blanket and sheet of fiberboard. Next, the covered form is run under heavy power-driven steel rolls to impress the type and photoengraving on the mat. After the paper mold has been dried, it is placed within a stereotype casting machine which casts a composition lead plate on the mold. In the larger plants, stereotype plates are usually cast automatically in a machine known as an autoplate.

Stereotyper examining stereotype impression of newspaper page which has just been formed under pressure of heavy steel rollers.

In many of the larger plants, electrotypers and stereotypers perform only one phase of the work, such as wax casting, molding, finishing, or blocking. However, journeymen must know how to handle all the tasks involved in their respective process.

Electrotypers and stereotypers are often employed in independent service shops which do this type of work for printing firms. Many electrotypers also work in large book and periodical plants. Stereotypers generally work in newspaper plants.

Training and Other Qualifications

Nearly all electrotypers and stereotypers have learned their trade through apprenticeship. Electrotypers and stereotypers are two separate crafts, and there is little transferability between the two. The apprenticeship training programs cover all phases of the particular trade and almost always include classes in related technical subjects as well as training on the job. Apprenticeship training for electrotypers and stereotypers usually covers a 5- or 6-year period requiring a total of from 10,000 to 12,000 hours of reasonably continuous employment.

Apprentice applicants must be at least 18 years of age and, in most instances, must have a high school education or its equivalent. In addition, mechanical training and courses in chemistry and metallurgy are helpful. Physical examinations and aptitude tests are often given to prospective apprentices. The emphasis placed upon various phases of training varies from plant to plant, however, depending upon the type of printing establishment. The following tabulation is an example of the work training apprenticeship schedule for stereotypers:

Type of work	*No. of months required*
Total	72
Elementary training (Acquaintance with stereotype room tools, materials, and machines.)	12
Matrix molding	12
Flat casting and job work (Including molding for reproduction purposes and use of various types of flat casting machines.)	24
Color register and curved routing (Principles of color register, use and care of curved routers, and nickel-plating.)	12
Casting machines (Use and maintenance of various types of hand-operated casting machines, pony autoplate machines, and other automatic casting machines.)	12

Employment Outlook

Continued increase in employment for electrotypers and stereotypers is anticipated during the late 1950's and the 1960's. The number of workers in these occupations increased about 50 percent between 1940 and 1955. The anticipated growth in the total volume of printing and particularly the increased amount of printing required for paper box containers will result in a substantial increase in the demand for electrotyping and stereotyping. Technological advances, such as the increased use of automatic plate composition, which eliminates many of the steps in the processes and the increased use of nonmetallic plates, such as rubber in commercial printing, however, may limit this growth of employment.

In addition to the increased employment opportunities, replacement needs will provide some job opportunities for new workers. However, these are relatively small occupational fields, employing about 12,000 journeymen in mid-1956. Growth in these occupations combined with replacement needs will result in several hundred openings annually.

Earnings and Working Conditions

Wage rates for electrotypers and stereotypers tend to be higher than for most printing trades. The minimum union wage rate in both the newspaper and book and job plants for electrotypers and stereotypers averaged over $3 an hour in most areas where there are concentrations of employment of these workers.

Minimum union wage rates for electrotypers in book and job plants in 53 cities of over 100,000 population as of July 1, 1956, ranged from $2.64 an hour in Jacksonville to $3.60 an hour in Newark. In newspaper plants, wage rates for stereotypers ranged from $2.75 an hour in Jacksonville and New Haven to $3.59 an hour in Chicago. Minimum union wage rates for electrotypers and stereotypers as of July 1, 1956, for important printing centers are shown in the following table:

City	Book and job	Newspaper
	Electrotypers	Stereotypers
Atlanta, Ga	$2.93	$2.81
Baltimore, Md	2.67	2.92
Boston, Mass	2.95	3.12
Buffalo, N. Y	2.95	2.97
Chicago, Ill	3.38	3.13–3.59
Cincinnati, Ohio	2.97	2.88
Cleveland, Ohio	3.15	2.96
Columbus, Ohio	2.94	2.98
Dayton, Ohio	3.14	2.93
Des Moines, Iowa	3.16	2.95
Detroit, Mich	3.40	3.18
Houston, Tex	----------	2.99
Indianapolis, Ind	2.91	2.98
Jacksonville, Fla	2.64	2.75
Los Angeles, Calif	3.26	2.96
Memphis, Tenn	2.80	2.81
Milwaukee, Wis	3.11	2.91
Minneapolis–St. Paul, Minn	3.24	2.93–3.10
Newark, N. J	3.60	3.04
New Haven, Conn	2.95	2.75
New Orleans, La	2.91	2.77
New York, N. Y	3.48	3.03
Oklahoma City, Okla	----------	2.85
Philadelphia, Pa	3.20	2.88
Pittsburgh, Pa	2.80	2.93
St. Louis, Mo	2.88	2.85
Salt Lake City, Utah	----------	2.83
San Francisco, Calif	3.16	2.95
Seattle, Wash	3.51	3.31
Washington, D. C	3.09	3.01

Much of the work does not require great physical effort since the preparation of duplicate printing plates is highly mechanized. However, there is some lifting of relatively heavy press plates.

Nearly all electrotypers and stereotypers are members of the International Stereotypers' and Electrotypers' Union.

Where To Go for More Information

International Stereotypers' and Electrotypers' Union, 752 Old South Building, Boston 8, Mass.

International Association of Electrotypers and Stereotypers, Inc.
701 Leader Building, Cleveland 14, Ohio

See also page 290 for additional sources of information.

Printing Pressmen and Assistants

(D. O. T. 4–48.010, .020, .030, and .060; 6–49.410, .420, and .430)

Nature of Work

The actual printing operation is performed in the pressroom. The type forms from the composing room, the press plates from the electroplating and stereotyping department, and the rotogravure and lithographic plates are all assembled and made ready for final printing by the pressmen. The pressmen's basic duties are to "makeready" and then tend the presses while in operation.

The object of the "makeready," which is one of the most delicate and difficult parts of the work, is to insure printing impressions that are distinct and even, and neither too dark nor too light. This is accomplished by such means as placing pieces of paper of exactly the right thickness underneath low areas of the press plates or type form to level it, and attaching pieces of tissue paper to the surface of the cylinder or flat platen which makes the impression. Pressmen also have to make many other adjustments—for example, those controlling margins and the flow of ink to the inking roller. In some shops, they are responsible not only for tending the presses, but also for oiling and cleaning and making at least minor repairs. On the larger presses they have assistants and helpers.

Pressmen's work may vary greatly among shops, primarily because of differences in the kinds and sizes of presses used. Small commercial shops, many of which are owned and run by pressmen themselves in partnership with compositors, generally have small and relatively simple platen (or job) presses that are often fed paper by hand.

At the other extreme are the big newspaper and magazine printing plants with their tremendous web-rotary presses. These giant presses are fed paper in big rolls. They print the paper on both

Pressman checking fidelity of press impressions—an important phase of "makeready" operations.

sides by means of a series of cylinders; cut the pages and assemble and fold them; and, finally, count the finished newspaper sections which emerge from the press ready for the mailing room. These steps are accomplished automatically by means of many different mechanisms, each of which calls for repeated attention while a run is being made. Presses of this kind are operated by crews of journeymen and less skilled workers directed by a pressman-in-charge.

Duties of press assistants range from feeding sheets of paper into hand-fed presses to helping pressmen make ready and operate large and com-

plicated rotary presses. Workers whose main responsibility is feeding are often referred to simply as feeders. The ratio of assistants to pressmen varies greatly from one establishment to another, depending on size of the plant, type of press used, and other factors. Many shops are too small to have any pressroom assistants.

Training and Other Qualifications

As in the case of other printing crafts, by far the most common way of learning the trade is through apprenticeship. However, some workers are able to pick up the trade while working as helpers or press assistants or through a combination of work experience in the pressroom and vocational or technical school training.

The length of apprenticeship and the content of training depend largely on the kind of press used in the plant. The apprenticeship period ranges from 3 to 5 years. The apprenticeship period for pressmen operating large presses is almost always 5 years in union shops. In addition to on-the-job instruction, the apprenticeship training involves related classroom or correspondence school work.

The following tabulation is an example of an apprenticeship training schedule for cylinder pressmen:

Type of work	*No. of hours*
Total	8,000
Care of pressroom equipment and accessories	500
Imposition and registering form on sheet	1,000
Makeready	1,000
Running the job and tending the press	2,000
Maintenance of press	1,000
Knowledge of inks	1,000
(Mixing, matching colors, etc.)	
Knowledge of printing paper	500
Repetition of all above work processes	1,000
(Grades, textures, etc.)	

Individual companies generally choose apprentices from among press assistants and others already employed in the plant. Young men may often work for 2 or 3 years in the pressroom before they are selected to begin the 3- to 5-year training period leading to journeyman status. A high school education or its equivalent is generally required. The increase in color presses and the fact that pressmen often mix their own inks make a knowledge of color necessary. Art courses are, therefore, very helpful. Physical strength and endurance are necessary for work on some kinds of presses, where the pressmen have to lift heavy type forms and press plates and stand for long periods. Mechanical aptitude is important in making press adjustments and repairs.

Employment Outlook

Continued steady increases in the number of printing pressmen can be expected in the late 1950's and the 1960's. Replacement needs will also provide many openings for new workers.

The number of pressmen has grown substantially in recent years, rising from about 33,000 in 1940 and 50,000 in 1950, to an estimated 55,000 in mid-1956. The anticipated rise in the volume of printing and the increased use of color in the next 10 to 20 years is expected to result in an increasing need for pressmen, although continued improvement in the speed and efficiency of printing presses may limit somewhat the rate of expansion for this skilled craft.

The need to replace workers who die, retire, or transfer to other fields of work will also result in job opportunities for new workers. Death and retirement alone will create about 1,000 job openings each year. At the end of 1956 there were about 3,800 registered apprentices in training and perhaps 2,000 others in training in unregistered programs.

Earnings and Working Conditions

What pressmen earn depends upon the make and style of press operated, the type of printing plant, and the locality. The Bureau of Labor Statistics' survey of minimum union wage rates in 53 cities of over 100,000 population shows that the average minimum hourly rate in effect on July 1, 1956, for newspaper pressmen-in-charge was $3.39; for newspaper pressmen (journeymen), $3.14; for book and job cylinder pressmen, $2.96; for book and job platen pressmen, $2.66; and for book and job press assistants and feeders, $2.40. The July 1956 minimum union hourly wage rates for important printing centers in selected pressroom occupations are shown in the following table:

City	Book and job	Newspaper	
	Pressmen, cylinder and rotary	Pressmen-in-charge	Pressmen, journeymen
Atlanta, Ga	$2.56–2.87	$3.15	$2.89
Baltimore, Md	2.44–2.78	3.13	2.93
Boston, Mass	2.55–3.05	3.05–3.38	2.87–3.12
Buffalo, N. Y	2.79–3.15	3.18–3.24	2.98–3.18
Chicago, Ill	3.18–3.63	3.31–3.45	3.14–3.31
Cincinnati, Ohio	2.35–3.02	3.06	2.93
Cleveland, Ohio	2.90–3.09	3.22–3.48	2.93–3.34
Columbus, Ohio	2.81	3.24	2.98
Dayton, Ohio	2.82–3.25	3.13–3.50	2.93–3.29
Des Moines, Iowa	2.64–3.31	3.09	2.89
Detroit, Mich	3.17–3.27	3.34–3.52	3.08–3.28
Houston, Tex	2.65–2.84	3.08	2.88
Indianapolis, Ind	2.61–2.82	3.28	2.98
Jacksonville, Fla	2.00	3.03	2.78
Los Angeles, Calif	2.97–3.25	3.16	2.96
Memphis, Tenn	2.40–2.49	3.09	2.83–3.02
Milwaukee, Wis	2.77–2.97	3.24	2.97–3.11
Minneapolis–St. Paul, Minn	2.92–3.14	3.17–3.25	2.90–3.00
Newark, N. J	3.08–3.23	3.32	3.12
New Haven, Conn	2.41–2.92	2.87	2.74
New Orleans, La	2.55	2.91	2.75
New York, N. Y	2.89–3.40	3.43–3.56	3.14–3.30
Oklahoma City, Okla	2.25–2.50	----------	2.85–2.98
Philadelphia, Pa	2.79–3.45	3.15–3.38	2.88–3.18
Pittsburgh, Pa	2.94–3.11	3.16	2.89
St. Louis, Mo	2.55–3.08	3.04–3.17	2.85–2.99
Salt Lake City, Utah	2.31	3.11	2.83
San Francisco, Calif	$3.09	$3.25	$2.96
Seattle, Wash	3.19	3.77	3.20
Washington, D. C	2.92–3.46	3.33	3.12–3.22

Pressrooms are unavoidably noisy and there are the usual occupational hazards associated with machinery. Pressmen also often have to lift heavy type forms and printing press plates. At times, they work under pressure to meet deadlines, especially in the printing of newspapers and magazines. Many pressmen work night shifts for which they receive premium pay.

Most pressroom workers are covered by union agreements. Practically all of the organized letterpress and rotogravure pressmen are members of the International Printing Pressmen and Assistants' Union of North America.

Where To Go for More Information

International Printing Pressmen and Assistants' Union of North America, Pressmen's Home, Tenn.

See also page 290 for additional sources of information.

Lithographic Occupations

Nature of Work

Lithography, though still much less common than letterpress work, is the most rapidly growing method of reproduction of printed matter. Practically all items printed by the letterpress process are also produced by lithography—including, books, calendars, maps, posters, labels, office forms, sheet music, and even newspapers. Lithography has special advantages when the copy to be reproduced includes photographs, drawings, or paintings, and particularly when these are in color.

In lithography (or offset printing), the press plate is smooth or nearly so, with both the image and nonimage areas on the same level, instead of on different levels as in letterpress and gravure work. Lithography makes use of the principle that grease and water repel each other. The image areas of the plate are coated with a greasy substance to which the greasy printing ink will adhere. On the press, before each inking, the plate is moistened with water with the result that only the image areas take up the greasy ink from the inking roller. In present day lithographic work, the plates are usually made by a photographic process, and the method is often referred to as photolithography.

There are a number of processes involved in lithography, and each is done by a specialized group of workers. The main groups of lithographic workers are cameramen, artists, and letterers, strippers, platemakers, and pressmen.

The *cameramen* (D. O. T. 4-46.200), begin the printing process by photographing the copy. As a group, they do several different kinds of photography, in black and white, or in color. They make photographs of drawings or other photographs and develop them. The individual cameraman nearly always specializes in either black and white or color photography.

After negatives have been made and developed, they frequently need retouching, to lighten or intensify certain parts, because the photographic process breaks up the lines, images, and designs of the printed material into a series of small dots. Thus, it is often necessary for *artists and letterers* (D. O. T. 4–46.700) to go over these dots and make corrections by sharpening or reshaping. This requires highly skilled workers and is done by hand with the use of chemicals, dyes, and special devices.

Artists may also correct colors in the final press plates. In addition, artists draw posters, or other pictures on stone or metal plates or on special paper on the comparatively rare occasions when hand methods are used in place of photomechanical methods.

To qualify as journeymen, artists must be adept either in one or more of the various retouching methods or in hand drawing with lithographic crayon. Like cameramen, they are customarily assigned to only one phase of the work and may then be known, for example, as dot etchers (who do a highly specialized type of retouching), retouchers, crayon artists, or letterers, depending on their particular job.

In photolithography, negatives or positives (made by cameramen and corrected by artists) are transferred to press plates by employees in the platemaking department. This can be done by either hand or machine methods. When hand methods are used, the *platemaker* (D. O. T. 4–46.300) covers the surface of the grained metal plate, usually zinc or aluminum, with a coating of photosensitive chemicals. After the plate has dried, the photographic negatives or positives are placed in contact with the sensitized plate and exposed under strong arc lights. The image is thereby formed on the plate from the negative or positive. In the machine process, the platemakers expose the prepared plate and the photograph in a vacuum printing frame or photocomposing machine. The plate is then developed and chemically treated to bring out the image.

The *lithographic pressmen* (D. O. T. 4–48.070) "makeready" and tend the lithographic printing presses. They install the plate on the press, adjust the pressure for proper printing, care for and adjust the rubber blanket to maintain quality work, adjust water and ink rollers for correct operation, mix inks, and operate the presses. Although the basic duties of the lithographic (offset) pressmen are similar to those of letterpress and gravure printing, there are a number of differences. (See p. 299.) These variations arise, at least in part, from the specialized character of lithographic presses. An offset press has 3, rather than 2, revolving cylinders. The first carries the curved printing plate; the second, a rubber blanket; and the third, the paper (or other material) on which the impression is to be made. The plate does not print directly onto the paper; instead, it transfers the impression to the rubber blanket around the second cylinder, which then offsets the image onto the paper. Controlling the dampening rollers and the ink flow for correct press operation presents extra complications for the pressmen. Moreover, in printing by this method, much less pressure is needed than in relief and gravure printing, and delicate and skillful adjustments by the pressmen are required to attain exactly the right pressure. In the larger plants, assistants and helpers are employed whose duties are similar to those of letterpress and gravure men. (See p. 299.)

Training and Other Qualifications

A 4- or 5-year apprenticeship covering the basic techniques of the lithographic process is usually required in order to become an all-round craftsman. An example of an apprenticeship training schedule for lithographic platemaker is shown in the following tabulation:

Department and type of work	*No. of hours required*
Total	10,000
Platemaking department [The preparation of zinc plates before sensitizing; coating and sensitizing plates; exposing plates to light (instruction in proper handling and exposing); learn developing and etching plates]	3,500
Stripping and opaquing [Practice in forms and simple layouts; opaquing and blocking out of unwanted areas; preparation of copy, such as pasteup copy and preparation for caremaman]	3,000
Placement of halftones in combination with type [Work preparatory to making the plate; blocking out for various colors (known as color separation); practice in forms and complicated layout]	2,000
Other processes and operations [Cutting, binding, stitching, assisting cameraman and pressman]	1,500

Generally, an apprentice applicant must be in good physical condition, a high school graduate, and at least 18 years of age. Appropriate aptitude tests are generally given to prospective apprentices. Vocational school training and training in photography or art are helpful in learning these crafts. Training emphasis is on the specific occupation in which journeyman status is being sought although, generally, an attempt is made in the training program to make the apprentice familiar with every lithographic operation.

Employment Outlook

A continued rise in the number of lithographic workers is expected during the late 1950's and the 1960's. Offset printing has expanded considerably in the post-World War II period, particularly in the commercial printing field where there have been a growing number of letterpress concerns establishing offset printing departments. At the beginning of 1956 there were an estimated 25,000 to 30,000 journeymen lithographic workers employed. Offset printing will probably continue to expand faster than the other two printing methods because of the greater use of photographs, drawings, and illustrations in printed matter, and the expanded use of color in many printed products. However, new technological developments in the offset printing field, particularly in the platemaking and press departments, may limit somewhat the expansion in lithographic employment.

In addition to employment opportunities that will result from the expected growth of employment in offset printing, the need to replace workers who die, retire, or transfer to other fields of work will also provide some job openings. Growth and replacement needs together are expected to provide about 1,500 to 2,000 job opportunities for new workers on the average each year during the last 1950's and the 1960's.

Earnings and Working Conditions

The following table, based on information from the National Association of Photo-Lithographers, gives minimum union wage rates in 25 cities in individual lithographic occupations, as of July 1956:

City	Artists and letterers	Platemakers and related workers	Cameramen	Pressmen
Atlanta, Ga.	$3. 02	$2. 89	$2. 89	$1. 83–3. 02
Boston, Mass.	2. 97–3. 44	2. 82–3. 04	2. 86–3. 18	2. 08–4. 55
Buffalo, N. Y.	3. 11–3. 53	2. 97–3. 03	3. 11	2. 26–3. 72
Chicago, Ill.	3. 15–3. 46	2. 93–3. 30	2. 90–3. 30	2. 42–4. 16
Cincinnati, Ohio	3. 06	3. 06	2. 89–3. 17	2. 29–4. 02
Cleveland, Ohio	3. 31	2. 88	2. 70–2. 88	2. 15–3. 78
Columbus, Ohio	3. 21	2. 98	2. 90	2. 19–3. 16
Dayton, Ohio	2. 85	2. 75–2. 93	2. 93	1. 98–3. 34
Denver, Colo.		2. 77	2. 41–2. 77	2. 07–3. 17
Des Moines, Iowa	2. 78–2. 97	2. 78	2. 98	2. 10–3. 12
Detroit, Mich.	3. 12–3. 31	3. 03–3. 19	2. 79–3. 00	2. 42–3. 89
Indianapolis, Ind.	2. 87–3. 10	2. 76–2. 98	2. 87–2. 98	2. 24–3. 27
Kansas City, Mo.	3. 32	2. 99–3. 09	2. 75–3. 10	2. 25–3. 92
Los Angeles, Calif.	3. 30–3. 44	3. 30	3. 38	2. 44–4. 01
Milwaukee, Wis.	3. 11–3. 23	2. 93–3. 11	2. 74–3. 18	2. 27–3. 85
Minneapolis–St. Paul, Minn.	2. 87–3. 26	2. 95–3. 01	2. 97–3. 08	2. 36–4. 03
New York, N. Y.	3. 46–3. 67	3. 09–3. 46	3. 36	2. 37–4. 31
Oklahoma City, Okla.		2. 63	2. 63	1. 94–2. 93
Philadelphia, Pa.	3. 25–3. 61	3. 00–3. 25	2. 83–3. 43	1. 96–4. 10
Pittsburgh, Pa.	3. 34–3. 53	3. 02–3. 34	2. 87–3. 34	2. 17–3. 71
Portland, Oreg.	3. 25	3. 11	3. 11	2. 30–3. 31
San Francisco, Calif.	3. 38–3. 53	3. 38	3. 47	2. 46–4. 27
Seattle, Wash.	3. 08	3. 08	3. 08	2. 18–3. 43
St. Louis, Mo.	3. 37	3. 02	2. 64–3. 02	2. 34–4. 26
Washington, D. C.	3. 38	2. 68–2. 93	2. 43–2. 81	1. 98–3. 23

In these cities, wage rates for artists and letterers ranged between $2.78 and $3.67 per hour. Rates for cameramen are generally below those of skilled artists, but in many plants the top-grade cameramen earn as much as the top-skilled artists. Workers who do multicolor work are generally higher paid than those who do black and white only. The wage rates shown for platemakers and related workers include men with varying degrees of skill and responsibility. The rates for journeymen platemakers are in the upper range of the rates shown. The wide range of wage rates shown for pressmen is due to the many different types and sizes of presses operated.

Because offset printing is a relatively new process, lithographic plants are among the most modern in the industry. Many are air conditioned and well lighted. Much of the work requires little physical effort since it involves the handling of photographic film rather than metal type forms.

The majority of lithographic workers are members of the Amalgamated Lithographers of America. A substantial number of offset pressmen and other offset workers belong to the International Printing Pressmen and Assistants' Union.

Where To Go for More Information

Amalgamated Lithographers of America,
143 West 51st St., New York 19, N. Y.

Lithographers National Association, Inc.,
420 Lexington Ave., New York 17, N. Y.

Lithographic Technical Foundation, Inc.,
131 East 39th St., New York 16, N. Y.

National Association of Photo-Lithographers,
317 West 45th St., New York 19, N. Y.

See also page 290 for additional sources of information.

Bookbinders and Related Workers

Nature of Work

Many items such as books, magazines, pamphlets, and small calendars must be sewed, stapled, or bound after they leave the printing shops. Much of this work is done by skilled workers (bookbinders) who numbered about 20,000 in mid-1956. Many of these workers are employed in shops whose chief business is bookbinding. However, a considerable portion of this work is done in bindery rooms of large book, periodical, and commercial printing plants or large libraries.

There are several different kinds of binderies serving a variety of purposes. Edition and pamphlet binderies (or bindery departments) bind the regularly published editions of books, magazines, and pamphlets printed in large quantities. Trade or job binderies do bindery work on contract for other printers, publishers, or other customers. Blank book and looseleaf binders bind ledgers and bookkeeping and accounting volumes.

Bindery workers assembling material on gathering machine.

Edition binding—making books in quantity out of the big, flat sheets of paper that come into a bindery from the pressroom or from an outside printer—is by far the most complicated kind of bindery work. The first step is to fold the printed sheets, each of which contains many pages, so that these pages will be in the right order. When so folded into sections of 16 or 32 pages, the sheets are known as signatures. The next steps are to insert any illustrations that have been printed separately, to gather and assemble the signatures in proper order, and to sew them together. The resulting book bodies are shaped in various ways, usually with power presses and trimming machines, and fabric strips are glued to the backs for

reinforcement. Sometimes the edges of the pages are gilded or colored. Covers are glued or pasted onto the book bodies, after which the books undergo a variety of finishing operations and, frequently, are wrapped in paper jackets. Machines are used extensively throughout the process.

Skilled bookbinders seldom handle all these different tasks although many journeymen have had training in all of them. In large shops, bookbinders are likely to be assigned to one or a few operations, most often to the operation of complicated machines. For example, they may operate a folding machine which takes the flat sheets as they come from the pressroom and folds them into signatures; a gathering machine which assembles the signatures in proper sequence; a smashing machine which creases folds of sewed-together signatures of unbound books and compresses them in a press; a backing and rounding machine which applies glue to the backs of several signatures, rounds the back, and, with additional reinforcement, stiffens the back of the book, forming a joint to which the book cover can be attached; or a casing-in machine which glues the book inside the cover.

In many binderies, especially large ones, much of the work is done by employees trained in only one operation or in a small number of related tasks. These workers, often classified as bindery workers or bindery hands, are mostly women (hence the common designation, bindery women). Their work closely resembles assembly line factory work. These workers assist in operating any one of several bindery machines and wrap packages of printed matter. Some of the hand or machine operations performed include assembling pages of booklets, pasting in inserts, machine sewing, gluing fabric reinforcement on signatures, operating power-driven staplers, and punching holes or perforating sheets of paper or cardboard. The small number of men involved are usually assigned to more intricate machine jobs, such as operating, assembling, trimming, and stamping. In all, about 40,000 women and men were employed in these operations in mid-1956.

Training and Other Qualifications

A 4- or 5-year apprenticeship which includes on-the-job training as well as related classroom instruction is generally required to qualify as a skilled bookbinder. Apprenticeship programs may vary considerably among the various types of shops. Where large quantities of books are bound on a mass production (edition) basis, emphasis is on the most modern machine methods. Where fine hand binding is done, the training is mainly in hand methods, including artistic designing and decorating of leather covers. For many years, hand bookbinding has been declining in importance.

To be eligible for apprenticeship, the apprentice must usually have a high school education and be over 18 years of age. Mechanical aptitude is helpful to the person entering this trade. The following tabulation is an example of a work training and apprenticeship schedule for bookbinders:

Type of work	*No. of weeks required*
Total term	208
Assembling (Stacking signatures, hand and machine sewing and backing)	26
Case construction	26
Casing (Gluing and pressing)	26
Renovating (Inspecting and repairing; re-covering books)	26
Use of punching machines (Selection of punches; setting punches; operation of punch machine)	13
Use of folder (Setting rollers; setting feed plates; setting feeder; watching for correct folding; replacing and repairing tapes)	13
Use of perforator (Setting perforating heads for straight perforation; setting perforating heads for strike perforation; setting guides; setting delivery guide)	13
Use of power cutter (Setting cutting machine; adjusting clamp; replacing cutting knives; sharpening cutting knives; operation of machine)	13
General (Drilling, marking, wire binding, gluing and padding, stitching, and numbering)	52

For the less skilled bindery occupations not classified as journeymen, the training period may last from several months to 2 years. In union shops, apprenticeship programs for women generally last 2 years, and formal programs are given which include classroom instruction as well as on-

the-job training. The following is an example of the apprentice training schedule for bindery women:

Period and type of work	*No. of hours required*
1st 6 months	1,000
Familiarize self with stock, counting, jogging, gathering, wrapping, banding, tipping, stripping, interleaving, gumming, hand folding, padding.	
2d 6 months	1,000
All types of work listed above, plus operating punching machine and sewing machine.	
3d 6 months	1,000
All types of work listed in first year, plus operating round cornering machine, perforating machine, and gang stitcher.	
4th 6 months	1,000
All types of work listed in first 1½ years, plus perfecting efficiency in work to which best suited.	

Employment Outlook

Little increase in the number of jobs for skilled bookbinders is expected during the late 1950's and the 1960's. Replacement needs, however, will result in several hundred job opportunities each year for new workers to learn the skilled bookbinding trade. There will be considerably more openings for the less skilled bindery jobs.

The anticipated expansion of bound printing matter is not expected to result in any significant increase in employment for the skilled bookbinder. Continued mechanization of bookbinding operations and the declining demand for fine hand bookbinding will limit the growth of this trade. On the other hand, these same trends should result in increased employment for the less skilled bindery workers. A large proportion of the less skilled bindery workers are women. Because there is considerable turnover among these employees, there will be a relatively large number of openings for women workers. Seasonal fluctuation in employment is more common in bindery work than in other printing occupations.

Earnings and Working Conditions

Wage rates for skilled bookbinders tend to be below the average of other printing crafts. The Bureau of Labor Statistics' survey of minimum union wage rates conducted in 53 cities of over 100,000 population showed, as of July 1, 1956, that the minimum hourly wage rate in book and job establishments for bookbinders was generally over $2.50 an hour and as high as $3.19 in Seattle, Wash. The wage rates for bindery women are considerably lower and are among the lowest for printing industry workers. The July 1955 union hourly wage rate for skilled bookbinders and women bindery workers in important printing cities are shown in the following table:

City	Bookbinders	Women bindery workers
Atlanta, Ga	$2.77	$1.48
Baltimore, Md	2.36	1.28
Boston, Mass	2.55	1.47
Buffalo, N. Y	2.60–2.65	1.45–1.58
Chicago, Ill	2.76–3.10	1.72–1.76
Cincinnati, Ohio	2.67	1.53
Cleveland, Ohio	2.83	1.48–1.55
Columbus, Ohio	2.85	1.58
Dayton, Ohio	2.53–2.84	1.45–1.68
Des Moines, Iowa	2.59–2.94	1.43–1.69
Detroit, Mich	2.80–2.96	1.59–1.70
Houston, Tex	2.62	1.48
Indianapolis, Ind	2.61	1.45
Jacksonville, Fla	2.00	1.25
Los Angeles, Calif	3.08	1.85
Memphis, Tenn	2.40	1.21
Milwaukee, Wis	2.73	1.65
Minneapolis-St. Paul, Minn	2.80–2.82	1.37–1.42
Newark, N. J	2.42–2.84	1.55
New Haven, Conn	2.62	1.36–1.41
New Orleans, La	2.50	1.30
New York, N. Y	1.87–3.01	1.30–1.56
Oklahoma City, Okla	2.38	1.30
Philadelphia, Pa	2.42–2.59	1.43–1.65
Pittsburgh, Pa	2.59	1.43
St. Louis, Mo	2.69–2.76	1.51
San Francisco, Calif	3.09	1.85
Seattle, Wash	3.19	1.79
Washington, D. C	2.75	1.40

A majority of bindery workers are members of unions. Most skilled bookbinders are represented by the International Brotherhood of Bookbinders.

Where To Go for More Information

International Brotherhood of Bookbinders,
901 Massachusetts Ave NW., Washington 1, D. C.

See also page 290 for additional sources of information.

MECHANICS AND REPAIRMEN

Automobile Mechanics

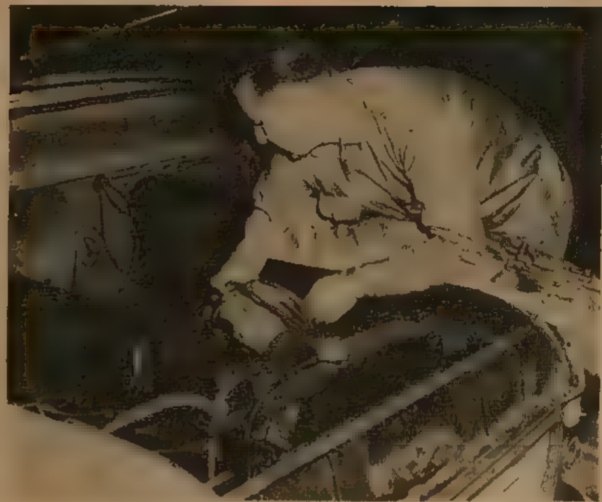
(D. O. T. 5–81.000 through .999)

Nature of Work

Automobile mechanics make up by far the largest repair occupation in the labor force. More than 700,000 automobile mechanics were employed in late 1956 to repair and maintain the more than 65 million passenger cars, trucks, and buses operating on American roads.

These skilled workers maintain and repair mechanical, electrical, and body parts of passenger cars, trucks, and buses. In many areas, they may also service tractors and other gasoline-powered equipment. Automobile mechanics make inspections and tests to determine the causes of faulty operation, and repair or replace defective parts to restore the vehicle to operating condition. Typical repair jobs done by mechanics are tuning the engine, replacing piston rings, alining the front wheels, and adjusting or relining the brakes. On unusual repair jobs, they may be guided by shop manuals and other technical publications.

In making repairs, the mechanic uses wrenches, hammers, pliers, drills, screwdrivers, and many specialized tools and gages. In larger shops, mechanics also operate a number of large, expensive machines which enable them to analyze and repair certain types of defects much more efficiently. Some of the more common examples of such equipment are wheel alinement machines, brake testers, engine analyzers, headlight aimers, and wheel balancers.



COURTESY OF U. S. NAVAL GUN FACTORY

Automobile mechanic making repairs on truck.

Auto mechanics in the smaller shops are usually general mechanics qualified to perform a variety of repair jobs. In large shops and in shops which specialize in a particular type of repair work, a great many mechanics are specialists, such as front-end and steering experts, automatic transmission servicemen, auto electricians, or body repairmen. Specialized repairmen in the larger shops usually have an all-round knowledge of automative repair and are occasionally called upon to do other types of work. However, body and fender repairmen, who are often trained only in the shaping and finishing of sheet metal, are usually not required to do other work.

Mechanics usually work by themselves. In large shops, however, the mechanic may be assisted by a helper or apprentice. Before actually doing the work, mechanics in small shops may be required to prepare estimates of the cost of repairs, including materials and labor time. In large shops, the foreman or service manager may prepare the cost estimate.

Where Employed

In 1956, more than three-fourths of the auto mechanics were employed in the service departments of new and used car dealers and in independent auto repair shops, which include general repair establishments as well as shops which specialize in a particular type of repair work, such as battery and ignition repair, body and fender work, radiator service, brake repair, and wheel and axle adjustment. Gasoline service stations, most of which provide only minor repairs and adjustments, employed about 4 percent of the auto mechanics.

Nearly one-fifth of the mechanics were employed by organizations which do not sell repair services, but merely provide maintenance for their own vehicles. In this group are trucking companies and bus companies, each of which employed about 3 percent of the auto mechanics in 1956; Federal, State, and local governments which together employed about 5 percent; and manufacturers of motor vehicles, which employed another 3 percent to make final adjustments and repairs. Other organizations which operate and maintain large fleets of vehicles, such as taxicab firms, bakeries, and dairies, accounted for most of the remaining auto mechanics in this group.

Most auto mechanics work in shops employing from 1 to 5 mechanics. However, some of the largest repair shops employ more than 100 mechanics. Generally, dealers' service departments in large cities have larger staffs of mechanics than independent shops and shops in the smaller communities.

Because motor vehicles are used throughout the Nation, automobile mechanics are employed in every section of the country from the largest cities to the smallest towns. The greatest concentrations of mechanics are found in States with the highest motor-vehicle registrations. In 1956, about half of the motor vehicles were registered in 8 States: California, New York, Texas, Pennsylvania, Ohio, Illinois, Michigan, and New Jersey.

Training, Other Qualifications, and Advancement

Most auto mechanics learn the trade through on-the-job experience. Young men usually start as helpers, greasers, or car washers, and gradually acquire the necessary knowledge and skills by working with experienced mechanics. Although a man can perform the simpler types of repair work after a few months' training and experience, it generally takes him at least 3 or 4 years to become a qualified all-round mechanic. Additional training time is usually required for mechanics who wish to become specialists. However, body repairmen, who do not have to acquire a technical knowledge of automotive mechanisms, can learn their trade in as little as 2 or 3 years if they have a knack for handling metal.

One of the best ways for a young man to become an all-round auto mechanic is through an apprenticeship training program. The apprentice may also choose a specialized field of training from among the following: Automobile engine mechanic, truck mechanic, bus mechanic, tractor mechanic, motorcycle repairman, brake mechanic, wheel alinement mechanic, auto generator repairman, auto electric repairman, auto body repairman, truck body builder, auto radiator man, and auto upholsterer. Most apprenticeship programs last 3 or 4 years, and include thorough and systematic instruction and experience in all phases of the work. Approximately 10,000 automobile mechanic apprentices were being trained in 1956 in programs registered with State apprenticeship agencies or with the U. S. Department of Labor's Bureau of Apprenticeship and Training. In addition, a considerable number of workers were being trained in programs not registered with apprenticeship agencies.

Experienced mechanics employed by automobile and truck dealers are sometimes sent to special centers for further training on new developments, such as power brakes, power steering, automatic transmissions, and other mechanical innovations.

For beginning jobs, employers prefer young high school graduates who have some understanding of automobile construction and operation and who like mechanical work. Courses in science and mathematics give a young man a better understanding of the principles of internal combustion engines, power transmission by shafts and gears, and electricity. Shop courses in auto repair which are offered by many high schools and vocational schools are valuable. Practical experience gained from working on automobiles as a hobby is also helpful to a young man who wishes to become a mechanic.

Most mechanics are required to have their own small handtools. A beginner is usually expected to have about $50 worth of tools. Experienced mechanics usually have over $500 invested in their tools, and a few men own tools valued as high as $2,000.

There are several advancement possibilitites for capable and experienced automobile mechanics. A mechanic in a large shop may advance to supervisory positions, such as repair shop foreman, service salesman, or service manager. Many experienced mechanics ultimately open their own independent repair shops or service stations.

Employment Outlook

The expected increase in the number of automobiles, trucks, and buses operating on the Nation's highways during the late 1950's and the 1960's will bring about a demand for thousands of additional auto mechanics to service and repair these vehicles. The number of automobile mechanics is expected to grow faster than the labor force as a whole. A considerable number of job openings will also be created by deaths, retirements, and transfers of auto mechanics to other fields of work. In this large occupation, deaths and retirements alone will create, on the average, about 8,000 to 10,000 openings each year during the 1956–66 decade.

Since World War II, the number of motor vehicles in the United States has increased very rapidly. Passenger car registrations increased from 26 to 52 million in the 1945–55 decade, while bus and truck registrations grew from 5 to 10 million. Further increases in motor-vehicle registrations are expected in the years ahead. Expected increases in population, household formations, consumer purchasing power, and 2-car families will greatly increase the demand for motor vehicles in the late 1950's and the 1960's. In addition, the continuation of farm mechanization is expected to increase the number of tractors and other gasoline-powered farm equipment.

Employment of automobile mechanics over the next decade will depend not only on the number of motor vehicles, but also on the amount of repairs required per vehicle and the productivity of the average mechanic. Since World War II, automobile manufacturers have added many features which make new cars more comfortable and easier to operate. Automatic transmissions, power brakes, power steering, and other postwar innovations have also considerably increased the complexity and the maintenance requirements of the average car. On the other hand, mechanics have greatly increased their efficiency over this period. New servicing equipment, which facilitates diagnosis and repair, greater emphasis on replacement rather than the repair of defective parts, better shop management, and better training of mechanics have all contributed to an increase in the mechanic's ability to make repairs. Although motor vehicles are expected to become more complex over the next decade, continuing technological developments will enable the average mechanic to service more automobiles, trucks, and buses. Therefore, employment of auto mechanics will grow at a slower rate than motor-vehicle registrations.

Another factor which might affect the employment of mechanics is the introduction of gas turbine engines to replace the present internal combustion engines. The widespread use of the gas turbine engine could reduce considerably the amount of engine repair work needed. However, such engines are not expected to be used in many vehicles in the next decade. In any event, the bulk of the automobiles in use will still be piston-engine cars for many years after the first gas turbine cars are sold.

Earnings and Working Conditions

Most journeymen auto mechanics earned from $2 to $3 an hour in late 1956. Generally, earnings were highest in new car dealer's service departments and large independent shops. Mechanics in the large cities generally received higher wages than those in smaller communities. Earnings also varied among the different types of mechanics, with body repairmen earning more than either general automotive mechanics or automotive electricians.

Mechanics in repair shops are often paid a percentage of the labor charge for the repairs they make. Each repair job is assigned a fixed labor charge and the most highly skilled mechanics can earn considerably more than the average because they are able to make repairs in less time. This is especially true in body work, in which there are great differences in skill between the very best repairman and the average repairman. A few body repairmen in large cities earn more than $10,000 a year.

Mechanics employed by trucking, taxicab, and bus companies and by other establishments which service their own vehicles are usually paid on an hourly basis. A survey of these workers conducted by the Bureau of Labor Statistics in 10 large cities showed hourly earnings in 1956 ranging from $1.81 in Memphis to $2.55 in the San Francisco–Oakland area.

Earnings of beginning mechanics ranged from $1 to $1.50 an hour in late 1956, varying with geographical location and the knowledge and training of the applicant. Apprentices are paid a percentage of the journeyman's rate. This per-

centage ranges from 40 to 55 percent of the skilled worker's rate in the apprentice's first 6 months of work to 85 to 90 percent in the last 6 months of the apprenticeship period.

The majority of auto mechanics in most areas work from 44 to 48 hours a week. The 40-hour week is common only in fleet maintenance shops and in a few large repair shops. A considerable number of mechanics work more than 48 hours a week. Long workweeks are especially common in the smaller communities.

Some auto mechanics are members of labor unions. Most union mechanics are employed in shops of the larger new car dealers and the maintenance shops of truck and bus companies. Repairmen are more highly organized on the West Coast, but there is some unionization in other parts of the country, particularly in large cities. Among the unions which organize automobile mechanics are the International Association of Machinists; and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America.

Working conditions vary considerably among shops. Most of the larger repair shops are pleasant places in which to work, but some of the small shops have poor lighting, heating, and ventilation. There is some danger of injury to men working on vehicles supported on jacks or blocking if proper safety precautions are not taken. In most jobs, the mechanic handles greasy tools and parts, and it is often necessary for him to stand or lie in awkward or cramped positions for extended periods of time. Although mechanics usually work indoors, they may occasionally go outside the shop to make emergency repairs on cars that have broken down on the road.

Where To Go for More Information

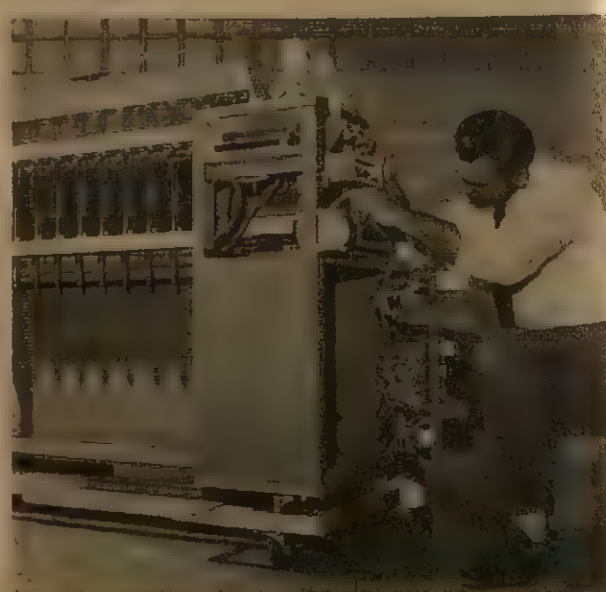
National Automobile Dealers Association,
2000 K St., NW., Washington 6, D. C.

Business Machine Servicemen

(D. O. T. 5–83.100 through 5–83.149)

Nature of Work and Where Employed

Business machine servicemen repair and maintain typewriters, adding machines, calculators, cash registers, accounting and statistical machines, and the many other types of machines used in business offices. These machines range in complexity from the relatively simple typewriters and adding machines to the tremendously complex electronic data processing machines. Consequently, the skills required to repair them vary considerably. However, the general work duties and the aptitudes needed in the different jobs are much the same, except in jobs servicing electronic equipment. The main job of business machine servicemen is to test and inspect the machines, diagnose the trouble, and then make the necessary repairs. They use such common handtools as screwdrivers and pliers, and special tools designed for the particular machine. They repair or replace broken or worn parts, adjust the various mechanisms, and clean and oil the machines. Most adjustments and repairs are made in the offices where the machines are used. However, for overhaul and more extensive repairs, the smaller machines are taken back to the repair shops. Business machine servicemen may be called upon to explain to operators how the machines work and how to avoid damaging them. In some companies, they also sell supplies used with the machines, such as paper, inks, and ribbons.



Serviceman making repairs on data-processing machine.

Business machine servicing offers considerable variety in work assignments. Like some other types of repair work, it requires analytical and reasoning ability. Each repair job presents a new problem, and many persons find considerable satisfaction in being able to diagnose the cause of the trouble and to put the machine back in good working order.

Business machine servicemen are employed in several types of establishments. Manufacturers of business machines employ about one-third of these workers in their sales and service offices throughout the country. Almost half of the servicemen work in small independent establishments, some of which are primarily repair shops, whereas others combine sales and service. The remaining business machine servicemen are employed in large organizations which have enough machines to justify employing full-time servicemen. The Federal Government, for example, employed about a thousand of these workers in mid-1956.

Business machine servicemen employed in manufacturers' branch offices work only on the manufacturer's products. In the larger branch offices, the men may specialize on 1 or 2 of the types of machines they sell. For example, if the manufacturer makes typewriters, adding machines, and accounting-bookkeeping machines, some servicemen may repair only typewriters and adding machines whereas others may specialize on the accounting-bookkeeping machines. In other companies, even in the larger branches, the men are "combination" servicemen, and work on all the types of machines the company makes. In manufacturers' branches in the smaller cities where there are fewer repairmen, it is impractical to have the men specialize on one type of machine, and most of the servicemen are "combination" repairmen.

Business machine servicemen employed in independent dealers' and repair shops usually work on more than one type of machine because these shops repair and service many makes and models of business machines. Most of them are small and employ only a few servicemen. However, in some of the larger independent shops, most of the repairmen may specialize on typewriters and adding machines of various makes which furnish the bulk of their business, while a few other men repair the more complicated machines.

Business machine servicing jobs are found throughout the country. Even relatively small communities usually have at least 1 or 2 shops which repair machines. However, most servicemen work in large cities, especially those with concentrations of office workers, such as New York or Washington, D. C.

Typewriter Servicemen. An estimated 17,000 servicemen were engaged primarily in repairing and maintaining typewriters in mid-1956, making this the largest business machine repair occupation. Typewriters are the most widely used business machines. In addition to being used in practically every business office, they are used by many individuals in their homes. Electric typewriters differ somewhat in operation from the ordinary mechanical machines, but the two types are enough alike so that the repairmen can usually learn to repair the electric machines after a brief period of additional training.

Typewriter repairmen are employed both in the local service branches of typewriter manufacturers and in independently owned local repair shops (which frequently sell typewriters as well as repair them). Many servicemen operate their own shops. Typewriter servicemen are found in almost every sizable community throughout the Nation.

Adding Machine Servicemen. In mid-1956, more than 2,000 servicemen were engaged mainly in the servicing of adding machines. Adding machines are simpler to repair than most other business machines. In some cases, servicing of both adding machines and calculators is combined in a single job. In independent repair shops, adding machines are often serviced by mechanics who also repair typewriters.

Adding machine servicemen are employed both in manufacturers' service branches, which are operated in connection with the sales offices of the firms, and in independently owned local repair shops. Other sources of employment are the Federal, State, and local governments, and a few large banks and other firms which use large numbers of adding machines.

Calculating Machine Servicemen. About 4,000 servicemen were employed primarily in the repair and maintenance of calculating machines in mid-1956. These machines, which have elaborate mechanisms, add, subtract, divide, multiply, and perform combinations of these operations. Calculating machine servicemen require more train-

The main jobs of the calculating machine repairman are to test and inspect the machines, diagnose the trouble, and then make the necessary repairs.

ing than typewriter or adding machine repairmen. In some cases, servicing of calculators is combined with the servicing of other business machines, particularly adding machines and accounting-bookkeeping machines.

Men servicing calculators are usually employed in manufacturers' local service branches which are operated in connection with the sales offices of these firms. However, a few work in independently owned local repair shops, most of which are small and employ only a few workers. Another source of employment is the Federal Government. Most servicemen are employed in the larger cities, where most of the calculators are used.

Cash Register Servicemen. Cash register repair and maintenance was the main work of more than 4,000 business machine servicemen in mid-1956. Next to typewriters, cash registers are the most widely used business machines. Cash registers vary greatly in complexity. The simplest models merely record transactions and total receipts and provide a change drawer. The more complicated cash registers tabulate several different kinds of information simultaneously on each transaction, such as identification of the clerk, department, type of merchandise, payment given, and change due, and provide printed receipts for the customer.

The great majority of servicemen primarily engaged in repairing cash registers are employed in the local service branches of the few manufacturing firms in this field. Some of the repair work, especially in smaller towns, is done in independently owned local shops which also repair other types of business machines.

Accounting-Bookkeeping Machine Servicemen. In mid-1956, repairing accounting-bookkeeping machines was the main job of about 3,000 business machine servicemen. Accounting-bookkeeping machines perform a variety of operations. Some post entries, some do billing, whereas others combine the functions of typewriters and computing devices. All models have keyboards, like typewriters and adding machines. These machines are used in firms which have a great deal of accounting and bookkeeping work, such as department stores, large retail and wholesale businesses, and banks. Many of the newer models are adjusted specifically for the accounting procedures used in a given customer's office. Servicemen set up the controls or programs for these machines from plans which have been drawn up by the customer and the salesman.

These servicemen are employed principally in large cities, where most of these machines are used. Most accounting-bookkeeping machine servicemen are employed in the local service branches of companies manufacturing this equipment. Only a small number work in independent repair shops.

Accounting-Statistical Machine Servicemen. In mid-1956, about 8,000 men were employed in maintaining and repairing accounting-statistical machines. These are the most skilled business machine servicemen. Accounting-statistical machines record, tabulate, and analyze great masses of accounting and statistical data. They include card punches, sorters, and tabulators, as well as special purpose machines used in punched card systems, such as collators, verifiers, multipliers, and reproducers.

New lines of electronic accounting-statistical machines which process tremendous masses of data with great speed have come into use in the 1950's. Most of these machines are manufactured by the same firms which produce the electro-mechanical accounting-statistical machines.

Electronic machines differ from mechanical types in that they operate on electronic circuits and components, which can be understood only by persons trained in electronics. About 3,000 of the 8,000 accounting-statistical machine servicemen specialize in servicing the new electronic machines.

The majority of these men received their electronics training in technical schools, in the armed services, or in training courses given by the business machine company for which they work.

Accounting-statistical machine servicemen are employed principally by a few firms which manufacture and service this equipment. They may be assigned by their companies to work anywhere in the United States, but they are usually stationed in one of the larger cities. They rarely transfer from one company to another.

Dictating Machine Servicemen. Dictating machines are used in business offices to record dictation on cylinders, discs, or sleeves which can be played back for typing. The newer dictating machines are electronic models which reproduce the voice much more faithfully than the older acoustic-type machines. Servicing is still largely a matter of mechanical aptitude since the mechanical sections of dictating machines break down more frequently than the electronic parts; however, the servicemen must have a working knowledge of electricity and electronics. Besides the standard office dictating machines, there are many special types, such as devices which record telephone conversations or conferences, which are maintained by dictating machine servicemen. About 2,000 men were employed in this small field in mid-1956.

Dictating machine repairmen are employed mainly in the larger communities either by the service branches of the manufacturers or by their distributors. In small towns, typewriter and adding machine repairmen may also learn to service dictating and transcribing machines.

Training, Other Qualifications, and Advancement

Business machine servicemen are generally hired as trainees, and acquire their skills through on-the-job training and work experience. In manufacturers' service branches, the men may also receive instruction in a company school. The length of training varies greatly with the type of machine serviced and the kind of shop in which a man is employed. The time required to become a skilled serviceman tends to be somewhat longer in independent shops because of the greater variety of work and the less formal nature of the training. Formal apprenticeship programs of from 2 to 4 years are conducted by some firms.

Most companies which have factory-authorized service branches prefer to hire young men without previous experience and train them to service just their line of machines. Independent shops, on the other hand, require men who can service various makes of machines, and will either hire men with previous experience or will give a new man informal training on several different types of machines.

Men newly hired for servicing work in the manufacturers' service branches are usually sent to a company school for several weeks of classroom work. They are considered skilled workers after 1 to 3 years of practical experience on the job. At some time during this period, the servicemen may be sent back to the company school for a few weeks to learn to repair more complicated machines. Even after becoming a skilled worker, a serviceman may occasionally return to the company school to take a special course in maintaining a new type of mechanism.

Men in independent shops generally learn the trade by working along with experienced repairmen, who instruct them in the techniques of the trade. Occasionally, men employed by an independent or franchised dealer will be sent to a manufacturer's school for a few weeks at the dealer's expense to learn to repair a particular make of machine. In most cases, however, men in independent shops receive no formal training.

Length of training depends largely on the type of machine the man is learning to repair, with the more complicated machines requiring the longer training periods. Typically, it takes from 1 to 2 years for a man to learn to repair an ordinary adding machine or a typewriter. Calculating machines require from 2 to 4 years of training and experience. Cash register repairmen learn their job in from 2½ to 3½ years, the last 6 months of which are usually spent in the company school. Skilled accounting-bookkeeping machine repairmen generally must have at least 4 to 5 years of training and experience. The first 1 or 2 years may consist of working as an adding machine, calculator, or cash register repairman, since this is considered valuable background for servicing accounting-bookkeeping machines.

Most accounting-statistical machines have considerable electrical equipment in them; many have electronic components. The companies which manufacture and service these machines, therefore, generally require that applicants have

had technical schooling in electricity or electronics. In qualifying for a job in the maintenance of the complex electronic data-processing machines, college courses in engineering are very helpful, though not essential. Young veterans who have had electronics training in the Armed Forces are especially desired by employers in this field. Men hired as trainees generally spend their first 2 months in on-the-job training. If they prove satisfactory, they are sent to a company school for a period of from 3 to 10 months. After completing the course, they work under supervision until they acquire enough skill to service and repair on their own. This period usually lasts from 12 to 18 months.

The qualifications generally needed for business machine servicing work are high school education and general mechanical aptitude. Neatness in dress and personal appearance and courtesy in dealing with customers are essential in this work because much of the servicemen's time is spent on customers' premises. Most companies place great emphasis on hiring men who can make personal contacts effectively. Most manufacturers' branch offices prefer to hire young inexperienced persons as trainees. These employers also give aptitude tests to prospective servicemen. Previous experience in other business machine companies is not given much weight in some of the larger companies, although some do credit it as partial training. Such experience is much more helpful in obtaining a job in a small independent shop which handles all makes of machines.

Servicemen in manufacturers' sales branches frequently have the opportunity to move into sales jobs, where their earnings are usually greater. Many of these men also have the opportunity to be promoted to supervisory jobs, such as foreman or service manager; men in large independent shops have similar opportunities. Experienced men sometimes open their own repair shops; men who work in the branch offices of some manufacturers are sometimes given sales franchises from the company and become independent dealers.

Employment Outlook

During the late 1950's and the 1960's, employment of business machine servicemen will continue to grow at a fairly rapid rate—somewhat faster than the labor force as a whole. The need for these workers will arise both from the increasing use of office machines in business and industry, and the greater maintenance requirements of the newer, more complicated equipment. Replacement needs will also provide some openings for new workers. However, business machine servicing is not a large field of work and only a few thousand young men will be able to enter this growing occupation each year.

Since the turn of the century, both private business firms and governmental bodies have experienced a great increase in the amount of clerical work required for conducting their business. With the greatly increased use of scientific management methods in the 1930's and the 1940's, the need of business for more and more records, correspondence, and reports expanded greatly. Millions of business machines have enabled clerical and administrative staffs to handle this greatly increased workload. The new electronic machines introduced in the 1950's have not only made vast improvements in accounting technique, but have also created a demand for better and more extensive records. Coordinating the multitude of operations of a huge corporation, insurance company, or Government agency and relating them to other developments in a fast-moving, highly industrialized economy is a job which demands information that is more and more accurate, timely, and voluminous, and which can be obtained only through the use of modern office machines.

The increased use of business machines and the greater complexity of this equipment have resulted in a significant rise in the number of servicemen. Employment in this occupation doubled in the post-World War II decade, rising to more than 40,000 by early 1956. Continued growth in employment of business machine servicemen is expected during the late 1950's and the 1960's. Some types of servicing work will grow faster than others. The greatest growth is anticipated for men who service electronic accounting-statistical and data-processing machines.

The need to replace servicemen who are promoted, transfer to other fields of work, die, or retire will also provide job opportunities for new workers. Since this is a relatively young group of workers, deaths and retirements will result in only about 500 to 600 openings annually.

Employment of servicemen tends to hold up fairly well through the ups and downs of general business activity. In prosperous periods,

sales of business machines generally increase, resulting in increased demand for servicemen. In less favorable times, sales of new machines have generally declined, but the increased wear and tear on the machines in use create a continuing need for maintenance work. Men who establish themselves in this field, particularly those employed by the large national concerns, are fairly well assured of continuing employment for many years.

Earnings and Working Conditions

In mid-1956, earnings of experienced servicemen generally ranged from $70 to $125 a week depending on where the man was employed, the type of machine he serviced, and his length of service with an employer. Wages were lowest for men who repair only typewriters or adding machines; the earnings of these workers usually ranged from about $70 to $80 per week. Cash registers, calculators, bookkeeping-accounting machines, and nonelectronic accounting-statistical machines require more skill to repair; consequently, the men who work on them receive somewhat higher pay rates, generally ranging from $80 to $110 a week. Highest rates are received by men who service electronic data-processing machines. In addition to their salaries, servicemen in some companies receive commissions for selling supplies or service contracts. Men employed by larger manufacturers are covered by pension and group insurance plans.

Servicemen trainees begin at wages considerably below these levels, and receive pay increases as they become more and more skilled during the training period. Starting wages generally ranged from about $40 to $60 a week in mid-1956. Men with prior electronics training in Armed Forces or civilian technical schools generally receive somewhat higher beginning wages.

Servicing and repairing business machines is cleaner and lighter work than most other mechanical trades. The occupation is comparatively free from the danger of accident. Servicemen generally dress like office workers, since the work is clean and is often performed in the offices where the machines are used. Many of these jobs involve considerable traveling within the area served by the employer.

Diesel Mechanics

(D. O. T. 5–83.931)

Nature of Work

Diesel mechanics maintain and repair diesel engines. When an engine breaks down or fails to operate properly, the mechanic diagnoses the cause of the trouble and makes the necessary repairs. Although the diesel engine is similar to the gasoline (or carburetor) engine, it has a different fuel feeding and firing system. However, the basic stationary and working parts are similar in both engines. As a result, diesel engine maintenance is usually performed by workers who are employed as engine mechanics rather than as specialized diesel mechanics. For example, diesel-powered buses, trucks, and construction machinery are usually maintained by automobile or tractor mechanics. Railroad electricians and machinists generally repair diesel locomotives.

When doing a major overhaul of an engine, the mechanic removes cylinder heads, pistons, valves, fuel injection parts, cylinder linings, connecting rods, main bearings, and other parts to examine them for defects. He checks tolerances and clearance of parts to locate defective parts. He repairs or replaces any defective parts and then reassembles and adjusts the engine.

Diesel mechanics sometimes use machine tools such as grinders, drills, and lathes to machine simple replacement parts for the engine. They also use handtools such as pliers, screwdrivers, and wrenches.

Where Employed

Because diesel engines are widely used in American industry and commerce, diesel mechanics are employed in all parts of the country. The greatest concentrations, however are in California, Texas, New York, and Pennsylvania. Among the more important sources of employment are buslines, trucking companies, railroads, shipping lines, electric power plants, logging camps, marine-engine repair establishments, and garages and firms that service diesel tractors and construction machinery.

COURTESY OF U. S. NAVAL GUN FACTORY

Diesel mechanics overhauling engine.

Training and Other Qualifications

Most diesel mechanics enter the trade by first learning how to repair gasoline engines. They usually start as helpers to automotive gasoline engine mechanics and acquire their skills by working with the more experienced craftsmen. It is possible for a man to perform the simple types of repair work after a few months' training and experience. However, it generally takes at least 3 to 4 years to be fully qualified to repair gasoline engines in automobiles, buses, trucks, construction machinery, and other types of equipment. Additional experience on diesel engine repair, usually ranging from 6 months to 1½ years, is required before a young man can qualify as a journeyman diesel mechanic. While they are learning the trade, many young men have found it helpful to take courses in the theory and practice of diesel engine repair and maintenance offered by vocational and trade schools.

Some diesel mechanics learn their trade through apprenticeship programs. These programs which generally last 4 years, include a combination of classroom training and practical experience. The apprentice receives classroom instruction in blueprint reading, hydraulics, welding, and other subjects related to the occupation. In his practical training, he works with valves, bearings, injection systems, starting systems, cooling systems, and other parts of the diesel engine. He also learns how to repair and maintain gas engines, air compressors, and other equipment.

Mechanics employed in servicing and repairing diesel locomotives are required to serve a 4-year apprenticeship. This apprenticeship program includes specialized training related to the repair of railroad equipment. Marine engineers, who are in charge of the operation and maintenance of diesel engines on ships, must be licensed by the U. S. Bureau of Marine Inspection and Navigation. Experience in the engine department of ships and a written examination are among the chief requirements for a marine license.

Employment Outlook

An increasing number of diesel mechanics will be needed in the late 1950's and the 1960's to maintain and repair the ever-growing number of diesel engines being used in American industry and on the roads and farms of the country. In addition to the new jobs which are expected to develop because of the greater use of diesel engines, many job openings will result when workers die, retire, or transfer to other fields of work.

Over the past several decades, the diesel engine has proved to be a reliable and economical source of power for locomotives, trucks, buses, tractors, construction machinery, and for many kinds of stationary machinery, such as pumping equipment, oil drilling equipment, and electric power generators. The growing use of diesels in the railroad industry is an indication of their increasing importance as a source of power. In 1940, there were only 800 diesel units used by class I railroads; by 1955 there were almost 25,000 diesel locomotives in use. The number of diesel engine trucks has also been increasing. Between 1946 and 1954, almost 68,000 diesel-powered trucks were sold in the United States. It is expected that the advantages of the diesel engine as a source of power will result in its more widespread use in the future.

Most industries in which diesel engines are used in large numbers are expected to expand their activities considerably during the late 1950's and the 1960's. Increased construction activity will

require greater numbers of diesel-powered bulldozers, cranes, and other machinery. The expanding petroleum industry will need many new diesel engines to run generators which supply power for drilling or pumping equipment. Diesel power will also be used to a greater extent in mining. Uranium mining, in which diesel power is used for ventilation, drilling, pumping, and haulage, is a new and growing branch of mining. The number of diesel-powered trucks and buses in the transportation industry will also probably increase. The growth of these industries and the greater use of diesel engines will result in a substantial increase in the number of diesel mechanics.

Most new jobs in this field will be filled by mechanics who have already had experience in repairing other types of engines. Companies changing over to the use of diesel engines usually retrain their experienced mechanics to service the diesel equipment. Companies which buy additional diesel engines to meet expansion needs try to hire experienced engine mechanics wherever possible. Men who have had school training but no practical experience in diesel repair work will probably be able to find jobs as trainees; however, they will find few opportunities to start as full-fledged mechanics.

Earnings and Working Conditions

Although no national data are available on the earnings of diesel mechanics, wage data collected from a few employers indicate that these workers were earning from $2 to $2.50 an hour in some large cities on the East Coast in late 1956. Mechanics engaged in the repair of diesel locomotives had average straight-time hourly earnings of $2.29 in December 1956. Diesel mechanics employed in some bus repair shops on the East Coast earned between $2 and $2.25 an hour in the same period.

Most of the larger repair shops are pleasant places in which to work, but some of the small shops have poor lighting, heating, and ventilation. If proper safety precautions are not taken, there is some danger of injury to men working on vehicles supported on jacks or blocking. In most jobs, the mechanic handles greasy tools and parts, and it is often necessary for him to stand or lie in awkward or cramped positions for extended periods of time.

Many diesel mechanics belong to labor unions. Some of the more important unions are the International Association of Machinists; the Sheet Metal Workers' International Association; and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America.

Electronic Technicians

Nature of Work and Where Employed

The rapid growth of radio and television, the greatly increased use of electronic equipment by the Armed Forces, and the application of electronics to a wide range of commercial and industrial processes have created a great demand for persons qualified to construct, maintain, and repair electronic equipment. These workers are generally referred to as electronic technicians.

All electronic technicians must have an understanding of the principles of electronics. Their particular job duties, however, depend on the type of equipment they work on and the industry in which they are employed. Electronic equipment includes devices which make use of vaccum tubes or transistors such as home radio and television sets, radar, guided missile controls, and electronic computers.

In general, the electronic technician diagnoses the trouble in a piece of equipment, conducts tests to verify or correct his diagnosis, and then makes the necessary repairs. Although this description applies most specifically to repairmen, other technicians who construct, install, test, and maintain electronics devices must also have the same basic skills. In manufacturing, the emphasis is on testing, inspecting, and troubleshooting. In research laboratories, construction of equipment from blueprints or wiring diagrams is one of the technician's main jobs. In aircraft plants, electronic technicians are most often concerned with fabrication and installation of electronic equipment. Technicians in broadcasting stations are primarily equipment operators, but they must have sufficient knowledge of electronics to repair any of the stations' electronic equipment.

An estimated 140,000 electronic technicians were employed in a variety of industries and activities in mid-1956. Radio and television repairmen, numbering about 80,000, were by far the largest group. About 17,000 technicians were employed in manufacturing industries, principally in plants producing radio and television sets, military and commercial electronic equipment, and aircraft. Radio and television stations employed about 14,000 men as broadcasting technicians. A few thousand electronic technicians worked in independent research firms and in the research laboratories of manufacturing concerns. The commercial airlines and the Civil Aeronautics Administration employed several thousand electronic technicians to maintain and repair radio and radar equipment used for guiding and communicating with aircraft in flight. More than a thousand electronic technicians worked for ocean shipping firms, maintaining radio and radar apparatus. Firms which manufacture electronic data-processing machines employed a few thousand electronic technicians as customers servicemen to install, maintain, and repair this equipment. State and local governments employed nearly 4,000 electronic technicians to maintain their radio and radar equipment.

The Armed Forces use a tremendous amount of electronic equipment, which is kept in good operating condition by three different groups of electronic technicians. Uniformed personnel make up the largest of these groups. In mid-1956, more than a quarter of a million members of the Armed Forces were engaged in operating or maintaining electronic equipment, with more than 100,000 specializing in the maintenance of such equipment as radio, radar, guided missile controls, fire control instruments, and other military electronic devices. (These servicemen are not included in the statistics or the descriptions given in this chapter.) More than 10,000 electronic technicians worked as civilian employees of the Armed Forces, performing skilled electronics maintenance work. The third group was made up of several thousand highly skilled electronic technicians employed by electronic equipment manufacturing firms. These men service the more complicated electronic equipment at military installations on a contract basis.

Because the work duties of electronic technicians are somewhat different in the various activities and industries, a description of the nature of the work in five of the main specialized fields is given below. (Additional information about other groups of electronic technicians appears in the chapters on Radio and Television Broadcasting, Electronics Manufacturing, and Aircraft Manufacturing elsewhere in this Handbook. See index for page numbers.)

Radio and Television Repair. Radio and television repairmen (D. O. T. 5-83.411 and 5-83.416) analyze and test home radio and television receivers requiring repairs to determine the location and nature of the trouble. They may use test equipment such as oscilloscopes, signal generators, voltmeters, and ohmmeters to trace and measure the flow of current through the various components in the circuits. When they have located the part

Television repairman checking vertical sweep voltage generator in television receiver.

or circuit which is not working properly, they make the necessary repairs. They replace worn-out tubes, condensers, resistors, and other parts, using electricians' handtools, such as pliers, screwdrivers, wrenches, and soldering gear. After making repairs, they adjust the equipment to proper operating condition. Radio and television repairmen make most major repairs on radio and television sets in the shop; minor repairs and adjustments are usually made in customers' homes. Some repairmen also install television antennas on roofs or in attics, stringing wire from the antenna to the television set.

Most radio and television repairmen work in small 2- or 3-man repair shops, often as partners. Some are employed in large repair shops, includ-

ing service branches of large manufacturing companies. Appliance stores, department stores, and other outlets selling radio and television sets also employ repairmen in their service departments.

The geographical distribution of radio and television repairmen generally follows the pattern of the distribution of television sets, most of which are located in the larger cities. In 1956, the metropolitan areas with the largest number of television sets in use were: New York, Chicago, Los Angeles, Philadelphia, and Detroit.

Radio and Television Manufacturing. Electronic technicians (D. O. T. 5–83.444 and 4–98.010 through 4–98.101) employed in plants manufacturing home radio and television receivers perform a variety of tests and inspections on subassemblies and sets as they pass through the assembly line. They also test, adjust, and repair completed receivers. Electronic technicians make the more complex tests themselves, and they set up testing equipment to be used by less skilled workers in making routine tests. Generally, they use the same types of testing instruments and handtools as radio and television repairmen. In 1956, the largest concentration of these technicians was in the Chicago area, with New York, Los Angeles, and Philadelphia also being important centers for radio and television manufacture.

Military and Commercial Electronic Equipment Manufacturing. Unlike radio and television factories, plants producing electronic equipment such as radar, electronic computers, transmitters, and guided missile controls are not organized on a mass production basis. Small orders of specially designed units make up most of the output of these plants. As a result, these firms devote a large proportion of their efforts to research, engineering, intricate assembly, and testing. *Electronic technicians* (D. O. T. 5–83.444 and 4–98.010 through 4–98.101) are used in these operations. Although their job duties are similar in many respects to those of electronic technicians in radio and television manufacturing, most of these jobs require greater skill. Assembling complicated parts of the equipment, making tests and inspections, and tracing and repairing defects in finished units are among the many tasks performed by these electronic technicians. Because the products of these plants are not made in large quantities, the tests and other operations are not generally repetitive. Technicians are, therefore, often called upon to help design and to set up new types of testing equipment.

More than half of the electronic technicians engaged in making military and commercial equipment were employed in the New York, Philadelphia, Chicago, Boston, Los Angeles, and Baltimore metropolitan areas in mid-1956.

Aircraft Manufacturing. Almost all military and commercial aircraft and guided missiles are equipped during their manufacture with a considerable amount of electronic equipment. It has been estimated that electronic devices account for from one-third to one-half of the cost of military aircraft (which comprised more than 90 percent of all aircraft production in 1955). Building this equipment into aircraft and missiles and putting it into good working order require the services of a great many *electronic technicians* (D. O. T. 5–83.444 and 4–97.910, 4–97.911 and 4–97.930). Job duties of these technicians include attaching electronic units to the airframe; connecting and wiring the equipment inside the plane; and testing the components, subassemblies, and final installations. Technicians must use a variety of testing equipment. In some cases, they may design and construct special testing equipment to handle new work problems.

These electronic technicians are generally distributed geographically in about the same way as aircraft manufacturing workers. In 1956, some of the metropolitan areas with heavy concentrations of aircraft employment were Los Angeles, New York, Seattle, San Diego, Wichita, Hartford, Fort Worth, and Dallas.

Research Laboratories. Electronic Technicians (D. O. T. 5–83.444 and 0–66.80) employed in research activities usually act as skilled assistants to professional engineers. Following engineers' general instructions, they build experimental circuits and equipment and devise and apply tests, using a variety of handtools and testing devices. They read and interpret blueprints and circuit diagrams, and make the many mathematical calculations necessary to the work. Most of these electronic technicians are employed in the research laboratories of manufacturing firms in the electronics and aircraft industries. Others work in independent research laboratories and in Government agencies.

Training, Other Qualifications, and Advancement

To qualify as an electronic technician in the various fields discussed previously, a young person must have a thorough knowledge of electronics theory and principles. This must generally be supplemented by work experience or further training in the particular electronics fields. Perhaps the best method of acquiring the basic knowledge is to take a course in electronics at a good technical school or institute. These schools provide classroom and workshop instruction in the fundamentals of electronics. They also give training in such fields as the functioning and repair of radio, television, radar, and other electronic equipment and in the operation and maintenance of broadcasting equipment.

Many technical institutes are set up to provide young persons with a sound technical background which enables them to qualify for subprofessional jobs. Technical institute courses differ from college curriculums in that they are shorter and much more concentrated on technical and scientific subjects. Very little time is devoted to the more general subjects taught at college, such as literature and the arts. To enter a technical institute, a person should be a high school graduate who has successfully completed courses in algebra and trigonometry. Most courses run from 1 to 2 years, with 2-year curriculums being most common.

In the early days of radio, knowledge of electronics was usually acquired by home reading and independent study. It is still possible for young men to become technicians by working up from lower level jobs in radio and television repair shops and manufacturing plants. However, these men usually have to study extensively on their own to qualify as technicians. Since employers generally prefer technical school graduates, formal training is, in most cases, a better and faster way to qualify for these jobs. More than half of the electronic technicians interviewed in a 1952 survey conducted by the Bureau of Labor Statistics in eight of the largest cities had received this type of training. The proportion was even higher among the younger men; two-thirds of the technicians under 30 years of age had had technical school training.

Since World War II, training received in Armed Forces technical schools has helped thousands of veterans to qualify for civilian electronic technicians' jobs. Young men interested in this field who are thinking of entering the Armed Forces would do well to investigate the opportunities for valuable electronics training and work experience they offer.

Although apprenticeship is a good method of acquiring knowledge and skill for electronics work, only a small proportion of electronic technicians are currently being trained by this method.

Because of the rapidly changing nature of this field, an electronic technician must continue his training throughout his working career. Many manufacturing plants conduct short training programs from time to time as new designs and methods are developed. Electronic technicians also may keep abreast of new developments through reading trade literature and attending lectures, demonstrations, and discussion groups sponsored by firms and associations in the field.

Although applicants for electronic technician jobs in each of the different fields are required to have the same general knowledge of electronics, additional qualifications sought by employers vary somewhat from one type of work to another. For radio and television repair jobs, men who can deal with customers courteously and effectively are preferred. Manufacturers of military electronic equipment and aircraft prefer men who have served in the Armed Forces as electronic technicians and are, therefore, familiar with this type of equipment. Research laboratories usually hire men who have a broad knowledge and interest in electronics theory; men with some college training are often preferred.

Employment Outlook

Electronic technicians will continue to have excellent opportunities for employment in the late 1950's and the 1960's. Not only will employment grow in existing fields of electronics, but many new areas of electronics work are expected to develop. The potentialities of electronic equipment are just beginning to be exploited. Just as our Armed Forces have come to depend heavily upon electronic equipment, so too will civilian industries find more and more applications for electronics.

Employment of radio and television repairmen will continue to increase during the late 1950's and the 1960's. The sharpest increases will come in the few remaining areas which are not yet served by television stations. In the established television areas, the amount of television repair

work will increase somewhat as the trend toward 2- and 3-set homes continues.

The widespread introduction of color television in the coming decade is also expected to increase the demand for repairmen. Present color television equipment is considerably more complicated than black-and-white television, and it requires greater skill on the part of the repairmen. The impact of color television on employment of repairmen will be most strongly felt during the late 1950's and the early 1960's, when color receiving sets will probably be installed in great numbers. However, as color television sets come into wider use, it is expected that improvements in design will make them simpler in construction and less susceptible to breakdown. In addition, repairmen will become better acquainted with the equipment and more efficient in making repairs. For these reasons, and because a color set will usually replace a black-and-white set in the user's home, the long-term effect of color television on employment of repairmen is expected to be moderate.

A substantial increase in employment of electronic technicians is expected in plants manufacturing military and commercial electronic equipment and aircraft. An increasing share of Government expenditures for defense will be used to purchase electronic equipment for aircraft, guided missiles, and other military items. The demand for civilian electronic equipment is also expected to increase considerably. Greatly increased use of electronic control equipment in manufacturing, communication and navigation equipment in transportation, and electronic data-processing machines in business offices will result in increased employment of electronic technicians in plants making this equipment.

Although the rate of growth in the different electronics fields is expected to vary, the fact that trained men are often able to transfer between fields makes these differences in outlook less significant.

Earnings and Working Conditions

There is a relatively wide range of earnings among electronic technicians. Beginning technicians were earning as little as $60 a week in mid-1956, whereas some of the more experienced men were earning as much as $150 a week. Differences in average earnings among fields are relatively small compared with the wide range of earnings within most specialized fields. Generally, electronic technicians employed in research and development work have higher earnings than other electronic technicians.

Although beginning radio and television repairmen are among the lowest paid of all electronic technicians, earnings of journeymen repairmen varied widely, with most repairmen earning from $70 to $130 a week in 1956. Generally, repairmen in the larger cities had the highest earnings.

Earnings of electronic technicians in radio and television manufacturing were generally lower than those of other electronic technicians. Most of the workers in this field were paid hourly rates ranging from about $1.75 to $2.50 in mid-1956. Some of these men find it possible to supplement their earnings by repairing television sets in their spare time.

Because of the considerable variation in skill requirements among electronic technician jobs in the manufacturing of military and commercial electronic equipment, their pay rates have a wide range. In 1956, technicians engaged in this type of work generally earned from $1.75 to $3 an hour.

Electronic technicians employed in aircraft manufacturing plants are among the better paid groups of electronic technicians. In 1956, most of these workers earned from $2 to $3 an hour.

Electronic technicians employed in manufacturing and research usually work the normal 5-day, 40-hour week, and receive time-and-a-half pay for overtime hours. Overtime work is more common in aircraft and electronic equipment manufacturing plants because of the complex scheduling problems in these industries. Radio and television repair shops, most of which are small establishments, usually have longer working hours. Although some of the largest shops have a 40-hour week, the 6-day, 48-hour week is the more common work schedule. Evening and weekend work is very common among radio and television repairmen.

Radio and television repair work is usually carried on indoors in pleasant, well-lighted surroundings. When repairs are to be made in customers' homes, repairmen must drive to the home, carry in their testing equipment and tools, and work in whatever space is available near the television set. Some physical strain is involved in carrying sets from customers' homes to the shop and back

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again. Perhaps the most hazardous work in this field occurs when new antennas are installed on roofs. Repairmen must climb ladders to the roof and walk about on inclined surfaces. In the repair operation itself, the major hazard is electrical shock, though serious injury from shocks is rare.

Plants engaged in manufacturing radio and television sets, electronic equipment, and aircraft are usually clean, well lighted, and well ventilated. The work is usually not very strenuous physically. Work assignments in aircraft and electronic equipment plants change frequently, giving the job a freedom from monotony which most technicians find desirable.

Working conditions in research laboratories are especially favorable to young men with a strong interest in new developments. The work is constantly changing, and the technician can often find great satisfaction in a sense of participation in the advance of scientific knowledge. Young men who wish to become engineers by attending college while working will find research jobs as technicians more valuable than other types of electronics experience.

Where To Go for More Information

Information about approved technical institutes can usually be obtained by writing to the department of education in individual States, or to the Engineers' Council of Professional Development, 29 West 39th St., New York 18, N. Y.

Industrial Machinery Repairmen

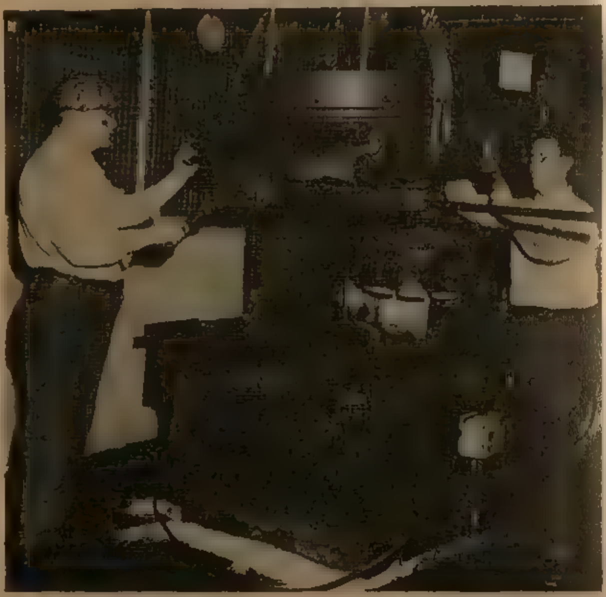
(D. O. T. 5–83.641)

Nature of Work

Industrial machinery repairmen, often called maintenance mechanics, maintain and repair machinery and other mechanical equipment used in a great variety of manufacturing establishments. When breakdowns occur, the repairmen must determine the cause of the trouble and make the necessary repairs so that the equipment is returned to good running order. To do this, they may dismantle or partly dismantle a machine in order to repair or replace defective parts. After the machine is reassembled, they usually make the necessary mechanical adjustments to insure correct operation.

A good part of the repairman's time is spent in preventive maintenance. By regularly oiling and greasing machines, replacing belts, and cleaning and repairing parts, he tries to prevent trouble which could cause a breakdown of operations. In large establishments, the industrial machinery repairman may keep a maintenance record of the equipment he services. Industrial machinery repairmen use wrenches, screwdrivers, pliers, and other handtools in their work. They may also use welding equipment in repairing broken metal parts.

Repairmen often follow blueprints, lubrication charts, and engineering specifications in maintaining and repairing equipment. They also use parts catalogs to order replacements for broken or defective parts. Occasionally, the repairmen may sketch a part which is to be replaced by the machine shop.



COURTESY OF U. S. NAVAL GUN FACTORY

Industrial machinery repairmen adjusting a section of a grinding machine while it is suspended by a hoist.

Where Employed

Industrial machinery repairmen are employed in almost every type of industrial plant which uses any great amount of machinery or equipment. Metalworking establishments, in particular, employ large numbers of these workers. For example, in late 1956, the automobile industry em-

ployed more than 8,000 maintenance mechanics and the machinery manufacturing industry employed about 6,000. Plants manufacturing goods other than metal products, such as textile mills, petroleum refineries, and paper and pulp mills, also employed many of these skilled craftsmen.

Because industrial machinery repairmen do maintenance work in such a wide variety of industries, they are employed in every section of the country. However, the greatest concentration of these workers is in New York, Pennsylvania, Ohio, Illinois, Michigan, New Jersey, California, Massachusetts, and other heavily industrialized States.

Training and Other Qualifications

Most workers enter this occupation by working as helpers and picking up the skills of the trade through several years of experience. Others learn the trade through formal apprenticeship programs. Apprenticeship training usually lasts 4 years and consists of both shop training and related classroom instruction. The apprentice learns the use and maintenance of the tools of the trade, the operation of the machinery and equipment which he will maintain, and the lubrication and adjustment of machinery. Classroom instruction is given in mathematics, blueprint reading, hydraulics, welding, and other subjects related to the craft.

Mechanical aptitude and manual dexterity are important qualifications for workers in this trade. Good physical condition and agility are also necessary, because industrial machinery repairmen are sometimes required to lift heavy objects or do considerable climbing in order to repair equipment located at high levels.

Employment Outlook

An increasing number of industrial machinery repairmen will be needed in the late 1950's and the 1960's to maintain and repair the growing amount of machinery and equipment being used in American industry. A substantial expansion in new plants, machines, and industrial equipment is expected in the 1956–66 decade in the industries which employ the largest number of repairmen.

The use of more expensive and complicated machinery is making repair work and preventive maintenance more essential. As production methods become more automatic and more integrated, manufacturers suffer higher losses from machinery and equipment breakdowns. The trend toward the use of more machine tools, transfer equipment, and assembling equipment in mechanized (automated) lines will require the employment of increasing numbers of industrial machinery repairmen.

In addition to the new job openings for industrial machinery repairmen created by industrial expansion, many new workers will be needed to replace those who die, retire, or transfer to other fields of work.

Earnings and Working Conditions

A winter 1956–57 wage survey of the Bureau of Labor Statistics shows the following average straight-time hourly earnings of industrial machinery repairmen employed in a wide variety of manufacturing and nonmanufacturing establishments in 12 large metropolitan areas:

Birmingham	$2.31
Boston	2.14
Buffalo	2.52
Cleveland	2.43
Dallas	1.97
Kansas City	2.40
Los Angeles–Long Beach	2.46
Philadelphia	2.38
Pittsburgh	2.55
St. Louis	2.31
San Francisco–Oakland	2.63
Seattle	2.47

The job of the industrial machinery repairman is usually not affected by seasonal changes in production. During slack periods, when production workers may be laid off, repairmen are usually retained for maintenance jobs. Many companies also use machine repairmen to do major repair and overhaul jobs during periods of curtailed production.

Because motors and other parts of machines are not always readily accessible, maintenance mechanics may work in stooped or cramped positions close to the floor or from the tops of ladders. The use of protective slings, metal helmets, and other devices enables these workers to perform their jobs safely.

Most industrial machinery repairmen belong to unions. Some of the more important unions in the trade are the International Union, United Steelworkers of America; the United Automobile, Aircraft & Agricultural Implement Workers of America; and the International Association of Machinists.

Jewelers and Jewelry Repairmen

(D.O.T. 4–71.010, .020, and .025)

Nature of Work

Jewelers are skilled workers who make and repair rings, pins, earrings, bracelets, and other ornaments. They work with small handtools such as drills, saws, files, and soldering irons; they also use jewelers' lathes and other machines to reshape old jewelry or make new jewelry. Jewelry craftsmen work with platinum, gold, silver, or other precious metals and with precious, semiprecious, or synthetic stones. Repair work includes making rings larger or smaller, soldering broken parts, and resetting stones.

Most precious jewelry is made by hand. The operations involved include preparing molds and dies according to design, casting metals, and placing precious and semiprecious stones in settings. As a rule, hand jewelers specialize in making a particular kind of jewelry; only after years of experience do some become all-round jewelers capable of making and repairing almost any kind of jewelry.

Costume and other less expensive kinds of jewelry are mass-produced by factory workers using assembly-line methods to make the finished product. Large manufacturing establishments producing inexpensive jewelry generally employ only a few highly skilled jewelers who perform a limited number of operations such as making jewelry models or tools.

Retail jewelers are primarily businessmen who buy and sell diamonds, watches, silverware, glassware, electrical appliances, and other merchandise. Although many retail jewelers are skilled craftsmen, an increasing number of the newer retail jewelry stores are owned or operated by merchants who are not jewelers. When repair work is brought to these merchants, they estimate the cost and then send the articles to a trade shop or back to the manufacturer for repairs.

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

This skilled jewelry worker is setting a diamond.

Where Employed

Most jewelers and jewelry repairmen work in retail jewelry stores, either as owners or employees, or in trade shops which serve these stores. Some are employed in jewelry manufacturing establishments; a few work for department stores and wholesale jewelry firms. Information on the exact number of jewelers and jewelry repairmen is not available. Furthermore, the functions of jewelry repairmen and watch repairmen overlap, and it is difficult to separate the two occupations. Jewelers were not reported separately by the Census Bureau in 1950 but were included in a combined total of about 45,000 employed jewelers, watchmakers, goldsmiths, and silversmiths. (For a discussion of watch repairmen, see p. 333.)

As a rule, each employer has only a few skilled jewelers. Many retail jewelry stores and trade shops employ only 1 or 2 skilled men. Precious jewelry also is generally manufactured in small shops, and even the few large establishments that manufacture costume jewelry are likely to employ only a limited number of trained jewelry craftsmen.

Although many small towns have at least one store which sells and repairs jewelry, most of the Nation's 25,000 retail jewelry stores, as well as the trade shops which service these stores, are located in and near large cities. Precious jewelry manufacturing is concentrated chiefly in the New York metropolitan area; the Providence, R. I., area is second in importance. In 1954, three-fourths of the 1,327 precious jewelry manufacturing plants were located in New York, Rhode Island, New Jersey, Massachusetts, and Pennsylvania.

Training and Other Qualifications

Young persons generally learn the jewelry trade either by serving a formal apprenticeship or through informal on-the-job training while working for an experienced jeweler. Jewelry repair, which is usually less complicated than jewelry making, can be learned in a short time by individuals already trained in filing, sawing, drilling, and other basic mechanical skills. Courses in jewelry repair are sometimes given in those trade schools which teach watchmaking and watch repairing.

Opportunities for obtaining on-the-job training are not widespread in this trade. Only a few of the larger shops are able to undertake formal apprenticeship training. Depending upon the specialty to be learned, the apprenticeship period ranges from 2 to 4 years; for example, it takes 3 years to become a stone setter and 4 years to qualify as a diamond setter. During each year of the apprenticeship, training on the job is supplemented by trade school instruction in design, quality of precious stones, the chemistry of metals, and other related subjects. The apprentice may begin as a charger, setting up the work for soldering, or he may do simple soldering or rough polishing. As he gains experience, he advances to more difficult work. On completion of the apprenticeship, he becomes a journeyman jeweler.

High school education is desirable for young people seeking to enter the trade. Courses in chemistry, physics, mechanical drawing, and art are particularly useful. Personal qualifications important for success in this field are mechanical aptitude, finger and hand dexterity, artistic ability, and good eyesight. For those planning to become retail jewelers, the ability to deal with people and manage a business is also important.

Employment Outlook

Skilled all-round jewelers with artistic talent and mechanical ability will probably be able to find employment readily during the late 1950's. Specialized jewelry craftsmen such as stone setters and model makers will also have favorable employment prospects, especially in manufacturing shops. However, beginning jewelers and those trained only in repair work may encounter difficulty in finding desirable employment. Opportunities to learn the trade through formal apprenticeship or informal on-the-job training are expected to remain limited.

Men planning to open their own jewelry stores should expect to face considerable competition in most parts of the country and should be prepared to make a substantial investment. As in the past, retail jewelers who can also repair watches will have an advantage over those who can work on jewelry only, especially in the smaller cities and towns. It should be borne in mind that this is a luxury trade and any downturn in general levels of business activity would adversely affect employment opportunities and incomes of jewelers.

In the long run, little expansion from current levels of employment of skilled jewelers and jewelry repairmen is expected in either jewelry manufacturing or retail trade. The anticipated growth in the number of retail jewelry stores is not likely to result in a comparable increase in employment of jewelers since many of the new stores will not be owned or managed by skilled jewelers. Most openings for skilled jewelers will arise through turnover and from the need to replace those who die or retire from the trade. However, such openings are expected to be relatively few because the field is a small one and because jewelers traditionally work at the trade well beyond the normal retirement age, provided they retain good eyesight and steady hands.

Earnings and Working Conditions

The earnings of jewelers engaged in retail trade follow closely the fluctuations in retail jewelry sales. Earnings are usually highest in the Christmas season and lowest during the summer. The size and location of the store also affect the incomes of retail jewelers.

More than three-fourths of the skilled jewelry workers employed by precious jewelry manufacturers in the New York City area are covered by a collective bargaining agreement between their employers and the International Jewelry Workers' Union. In 1956, the agreement provided that apprentices were to start at $1.05 an hour and receive an increase every 3 months until they reach the applicable minimum rate for journeymen. The minimum journeyman rates were $2.10 for stone setters, $2.25 for jewelers doing hand-

work, and $2.50 for model makers and diamond setters.

Skilled workers in the precious jewelry manufacturing shops of the New York City area have a 35-hour workweek and are paid time and one-half for all work done before or after the regular workday. On the other hand, retail jewelers and jewelry repairmen regularly work longer hours. In addition, they may do a considerable amount of overtime work, especially during the Christmas season.

Where To Go for More Information

International Jewelry Workers' Union,
19 West 44th St., New York 36, N. Y.

Maintenance Electricians

(D. O. T. 4–97.420)

Nature of Work

Maintenance electricians are skilled craftsmen who are responsible for the efficient operation of motors, transformers, generators, and other electrical equipment used in manufacturing and commercial establishments. A large part of the maintenance electrician's work consists of detecting trouble spots and repairing defective equipment to prevent electrical breakdowns. When trouble does develop, the electrician must quickly find and repair the faulty wiring or equipment in order to prevent production losses and inconvenience.

In the course of his daily work, the maintenance electrician performs many different jobs. For example, he may install new electrical equipment or he may make repairs by replacing wires, fuses, transformers, or switchboards. While doing repair or installation work, the electrician may link wires by splicing them and cutting away the insulation, twisting the wires together, soldering the connection, and applying friction tape. He may also measure, cut, bend, and install conduits through which wires are connected to outlets, panels, and boxes.

In testing electrical equipment and wiring, the maintenance electrician uses such devices as ammeters, voltmeters, and test lamps. He sometimes works from blueprints, drawings, layout, or other specifications when doing repair or installation jobs. He may make mathematical computations relating to load capacities of electrical wiring. His many different tasks call for the use of a large variety of handtools such as wrenches, soldering irons, screwdrivers, hacksaws, and pipe bending and threading tools.

Although all maintenance electricians use the same tools and possess the same basic skills, the nature of their work depends in large part on the particular industry in which they are employed. The maintenance electrician in manufacturing plants usually repairs or maintains the electrical equipment operated in connection with the production of a specific item. For example, a steel mill requires a large number of electricians to keep its rolling mills, heavy cranes, and other electrical equipment in good working order. In large office buildings or apartment houses, skilled electricians are needed to maintain wiring, motors, and compressors used in the operation of elevators, refrigerators, lights, and other electrical equipment and fixtures.

Where Employed

There were about 150,000 maintenance electricians employed throughout the country in late 1956. Slightly more than half of these craftsmen were engaged in servicing the equipment and machinery used in manufacturing plants. About 14,000 of these workers were employed by manufacturers of primary metal products; 12,000 were working in factories producing machinery of all types; and 7,000 were employed in chemical and allied products plants. The widespread use of maintenance electricians is shown by the fact that 10 other manufacturing industries each provided employment for 2,000 or more of these skilled workers.

Of the maintenance electricians working in nonmanufacturing establishments in late 1956, about 40,000 were working in retail and service enterprises; State and Federal Governments employed another 18,000; and approximately 8,000 were employed in maintaining and repairing the electrical equipment of mines. The balance were working in finance and wholesale trade establishments.

Although the jobs of maintenance electricians are widely distributed throughout the United States, the largest number of these workers are

employed in those States which are heavily industrialized and which have the greatest concentration of population. In late 1956, 5 States—New York and Pennsylvania (10 percent each), Illinois and Ohio (7 percent each), and California (6 percent)—accounted for 40 percent of the employment of these workers.

The fact that maintenance electrician jobs are located in almost every city and town throughout the Nation is an important consideration for many young people since the choice of an occupational field is frequently limited by ties of home, family, and friends. Prospects of being employed near home are much better in this field than in many other skilled occupations. Skilled workers in this trade also have the advantage of being able to transfer to different industries. They may also be able to transfer into construction electrician jobs with some retraining.

Training and Other Qualifications

Maintenance electricians can learn the skills of their trade through formal apprenticeship programs, by informal on-the-job training, or by accumulating experience through a series of jobs in their trade. Most training authorities agree that apprenticeship programs give the worker more thorough preparation, a broader background, and greater job mobility in his future working life.

The apprentice program for maintenance electrician usually lasts about 4 years. Apprentices are given on-the-job training and related technical classroom instruction in such subjects as drafting, mathematics, and electrical theory. The following list is an example of work experience and supplemental training that may be required of an electrician apprentice who is to work in an industrial establishment.

A young man employed in a small plant may learn his job by working as a helper to a skilled craftsman. By observing the skilled journeyman and receiving instruction from him, the helper gradually acquires the skills of his trade. Other electricians learn the trade by working in the maintenance department of a plant and picking up some of the fundamentals of the electrician's job. By moving from job to job, they acquire sufficient experience so that they are eventually hired as journeymen electricians.

Example of an apprenticeship training schedule for maintenance electricians

Work schedule	*Approximate hours*
Total	8,000
Commercial and industrial wiring Signal wiring Power wiring Control equipment Lighting circuits Wire splicing Fixture work	1,856
Assembly Wiring and repair Hanging Check and repair equipment Rigid conduit installation Motor troubles, detection and repair Transformers Repair compensators Safety methods	1,856
Install light and power equipment Signal equipment Replace fuses, bulbs Maintain electrical circuits and equipment Appliance repair Safety methods	1,856
Motor repair Welding, brazing, and burning General maintenance Safety methods First aid Electronic controls and circuits Induction heating	1,856
Related technical instruction	
Drafting and electrical layout	144
Electrical mathematics	144
Electrical theory	144
Electrical laboratory	144
	576

A young man interested in becoming a maintenance electrician would do well to include courses in physics, mathematics, and shopwork in his high school or vocational school curriculum. Because the electrical field is subject to constant change, many experienced electricians must continue to learn new skills in order to do their job. For example, many maintenance electricians may be required to learn basic electronics in order to service the new electronics equipment now being introduced in the Nation's factories and large residential and commercial buildings.

In selecting apprentice applicants or trainees, employers look for young men who have manual dexterity and are interested in learning how electrical equipment functions. Although great physical strength is not essential, agility and good health are important.

Employment Outlook

A substantial increase in the number of maintenance electrician jobs is expected in the next decade. The anticipated industrial growth of the country and the long-term trend in the increased use of electrical equipment should provide favorable employment prospects for these skilled craftsmen.

As the amount of electrical equipment and facilities in use has expanded, the maintenance electrician occupation has grown from a few thousand workers at the turn of the century to an estimated 150,000 in late 1956. Electric power production has doubled every 10 years since 1900 and it is expected to double again in the next decade. About half of the electric power generated today is consumed by industrial concerns, and a considerable portion of the remainder is used in large office, hotel, and apartment buildings. With well over half of the electricity being used in establishments which employ maintenance electricians, it can be expected that the anticipated expansion in electrical power production will result in increased employment of these workers.

The maintenance electrician occupation is one which will be favorably affected by the trend toward the use of electric and electronics devices in automatic manufacturing processes. While this shift toward automation may result in a decrease in the requirements for some types of production workers, increased numbers of maintenance workers, such as electricians, will be needed.

In addition to the new job openings which are expected to develop as a result of industrial expansion and the increased use of electrical equipment, many new workers will be needed to replace the workers who die, retire, or transfer to other fields of work. Deaths and retirements alone may create about 2,500 to 3,500 new job openings a year during the 1956–66 decade.

Earnings and Working Conditions

In general, the earnings of maintenance electricians compare favorably with those of other skilled craftsmen. The following table, based upon winter 1956–57 wage surveys made by the Bureau of Labor Statistics indicates the average straight-time hourly earnings of maintenance electricians in 12 large city areas:

Birmingham	$2.66
Boston	2.32
Buffalo	2.63
Cleveland	2.58
Dallas	2.18
Kansas City	2.58
Los Angeles–Long Beach	2.66
Philadelphia	2.47
Pittsburgh	2.66
St. Louis	2.63
San Francisco–Oakland	2.71
Seattle	2.51

The work environment of the maintenance electrician varies greatly from job to job. In the course of a single day, an electrician employed in a plant may repair electrical equipment both in a clean air-conditioned office and on the factory floor amidst the noise, oil, and grease of machinery. In order to install or replace electrical equipment, pull cable, and perform other repair jobs, maintenance electricians may sometimes be called upon to climb ladders, work on scaffolds, or work in awkward or cramped positions.

Because they often work around high voltage industrial equipment, maintenance electricians must be alert and accurate in carrying out their duties. Errors in wiring installations could have dangerous consequences to the electrician as well as to the operating employees. The safety principles which are now part of all training programs have greatly reduced the frequency of accidents. All well-trained maintenance electricians are taught to use protective equipment and clothing, to respect the destructive potential of electricity, and to handle small electrical fires.

Maintenance electricians belong to different unions depending upon the industry or plant where they are employed. Many of these craftsmen are members of the International Brotherhood of Electrical Workers. Other unions to which maintenance electricians belong are the International Union of Electrical, Radio and Machine Workers; the International Association of Machinists; the International Union, the United Automobile, Aircraft, & Agricultural Implement Workers of America; and the United Steelworkers of America.

Where To Go for More Information

The National Joint Apprenticeship and Training Committee for the Electrical Industry,
1200 18th St., NW., Washington 6, D. C.

The International Brotherhood of Electrical Workers,
1200 15th St., NW., Washington 5, D. C.

The State Supervisor of Trade and Industrial Education or the Local Director of Vocational Education in the State and/or city in which a person wishes to receive training will have lists of training institutions.

Millwrights

(D. O. T. 5–78.100)

Nature of Work

Millwrights are skilled workers whose principal job is to move and install machinery and other heavy equipment used in industry. They must know the structure and operation of the equipment on which they work because, after dismantling and moving machines, they must also reassemble them at the new site. In doing this work, they fit bearings, aline gears and wheels, connect belts, and attach motors. They often work from blueprints when preparing platforms on which machines are to be mounted or when laying out or installing plant equipment and machinery.

Millwrights use hoists, cranes, jacks, crowbars, wooden blocking, and other rigging equipment to move heavy equipment. They use hammers, wrenches, screwdrivers, and other handtools in assembling machinery. When alining machinery, they may also use measuring devices such as micrometers and calipers.

In addition to installing, assembling, and disassembling machinery, millwrights often repair and maintain such equipment as conveyors, cranes, hoists, and balers. Their maintenance and repair duties may include the oiling and greasing of machinery, the replacement of worn or broken belts, and the welding of metal parts. Millwrights sometimes work as part of a maintenance team of pipefitters and machine repairmen in keeping an automatic production line in operating order.

COURTESY OF U. S. NAVAL GUN FACTORY

Millwrights using crowbars to guide machine into position as it is lowered by hoists.

Where Employed

Most millwrights are employed in those industries which use heavy machinery and equipment. The principal employers of the 70,000 millwrights at work in late 1956 were the automobile, iron and steel, machinery, woodworking, pulp and paper, and construction industries. The automobile and steel industries, which are particularly dependent upon massive equipment in their manufacturing operations, together employed about 20,000 of these skilled workers.

Other millwrights are employed by companies which specialize in the assembling, disassembling, and moving of industrial machinery on a contract basis. Some also work for machinery manufacturers who employ millwrights to install their products in customers' plants.

Millwrights work in every State. However, about half of them are employed in the heavily industrialized States of Ohio, Michigan, Pennsylvania, New York, and Illinois.

Training and Other Qualifications

Workers enter this occupation through apprenticeship training programs or by picking up the skills informally. Those workers who pick up the trade, work as helpers to journeymen over a period of years until they acquire sufficient knowledge and experience to be classified as skilled workers. Most training authorities agree that apprenticeship programs give young persons a more thorough preparation for this skilled trade. Apprenticeship programs generally last 4 years. Apprentices are given shop training in dismantling, erecting, and repairing machinery and equipment. They are also trained in floor layout, the installation of machinery and electric motors, welding, and the erection of structural steel, plate steel, conveyors, and building beams. The apprenticeship program includes related classroom instruction in mathematics, general science, blueprint reading, hydraulics, and electricity. Many companies prefer that apprentice applicants be high school graduates between the ages of 18 and 26.

High school courses in mathematics, mechanical drawing, and shop work will be useful to young persons interested in becoming millwrights. Because millwrights often assemble and disassemble complicated machinery, mechanical aptitude will be helpful to young men entering the trade. Strength and agility are other important qualifications for millwright work, which often requires considerable lifting and climbing.

Employment Outlook

This occupation will offer employment opportunities for many new workers during the late 1950's and the 1960's. It is expected to expand at a faster rate than the Nation's labor force.

New plant and equipment expenditures by the industries employing millwrights are expected to be higher in the 1956–66 decade than in the previous 10 years. The building of new plants, the addition of new machinery, new plant layouts, and the maintenance of increasing amounts of heavy machinery and equipment will all require the skills of millwrights.

The trend toward mechanization (automation) which is taking place in American industry will also result in an increased demand for millwrights. The automobile industry is an example of an industry which is expected to further mechanize its machining and assembling operations. Millwrights will be needed in greater numbers in this industry to install, move, and maintain machine tools, presses, transfer equipment, conveyor systems, and mechanized assembly lines.

In addition to the new job openings which are expected to develop because of industrial expansion and increased mechanization, about 1,400 to 1,600 workers will be needed each year during the 1956–66 decade to replace the millwrights who die or retire. Replacement needs will also be created by those who shift to other lines of work.

Earnings and Working Conditions

The earnings of millwrights depend upon the city where they are employed as well as the type of business in which their employer is engaged. According to a winter 1956–57 survey by the Bureau of Labor Statistics, the average hourly earnings of millwrights employed in manufacturing industries in 11 large metropolitan areas ranged from $2.19 in Boston to $2.66 in San Francisco–Oakland. Average straight-time hourly earnings of millwrights employed in manufacturing plants in the areas studied were as follows:

Boston	$2.19
Buffalo	2.54
Cleveland	2.50
Dallas	2.25
Kansas City	2.58
Los Angeles–Long Beach	2.60
Philadelphia	2.36
Pittsburgh	2.63
St. Louis	2.60
San Francisco–Oakland	2.66
Seattle	2.39

Millwrights employed by companies doing contract installation work and construction companies usually earn more than those employed in manufacturing industries. For example, the union wage rate for millwrights employed by contract installation companies in Chicago was about $3.30 an hour in mid-1956. The union wage rates for millwrights working in the building trades in July 1956 ranged from $2.53 an hour in Charlotte to $3.58 an hour in Cleveland. The rate in Rochester was $3.40; in Detroit, $3.37; in St. Louis, $3.25; and in the San Francisco–Oakland area, $3.20. The wage rates for apprentices generally start at approximately 50 percent of the skilled worker's rate and progress to the full rate by the end of the training period.

Millwrights employed by manufacturing companies often have more job stability than those working for construction companies or millwright companies which do work on a contract basis. Although the work of millwrights is not seasonal, the latter employees may have short periods of unemployment between jobs.

The work of millwrights occasionally involves certain hazards. For example, they work with hoists and cranes in moving heavy machinery and equipment and must often work on high ladders. They are also subject to the hazard of falling objects. In recent years, accidents have been reduced by the use of protective devices such as safety belts, metal hats, and shoes with metal toes.

Most millwrights belong to unions. Some of the more important unions to which these workers belong are the International Association of Machinists; United Brotherhood of Carpenters and Joiners of America; United Steelworkers of America; International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; and International Brotherhood of Pulp, Sulphite and Paper Mill Workers.

Refrigeration and Air-Conditioning Mechanics

(D. O. T. 5–83.941)

Nature of Work

Refrigeration and air-conditioning mechanics install, maintain, and repair refrigeration and air-conditioning equipment used in such places as theaters, food stores, restaurants, homes, factories, and office buildings. In installing a new refrigeration or air-conditioning unit, the mechanic positions motors, condensers, and humidifiers in accordance with design specifications. He also assembles and connects piping and refrigerant lines and then connects the equipment to an electrical power source. He installs electrical controls and checks the voltage entering the motor. After completing the installation and connecting the recording and gaging devices, the mechanic starts the unit and tests it for proper performance and for leaks. He adjusts the pumps, humidifiers, filters, and other components in order to obtain the most efficient performance. On larger installation jobs, the mechanic must read and interpret blueprints or drawings. On smaller installations, he may have to prepare his own sketches and do simple layout work such as measuring and cutting pipe.

Mechanic charging a freezer with refrigerant.

Mechanics engaged in maintenance work regularly lubricate the machinery, replenish the refrigerant, adjust valves, and examine other parts of the unit in order to detect leaks and other defects before serious trouble develops. When refrigeration and air-conditioning equipment breaks down, the mechanic must diagnose the cause and make the necessary repairs. In looking for defects, he may disassemble such parts as springs and brushes. After the cause of the trouble has been located and the defective part repaired or replaced, the mechanic reassembles the unit. He may also make electrical repairs in connection with his work. The mechanic uses tools and equipment such as electric drills, soldering torches, flaring tools, benders, hammers, screwdrivers, and pliers, and testing devices such as leak detectors, and test lights.

Where Employed

A considerable number of these mechanics are employed in shops which specialize in the repair and maintenance of commercial, industrial, and home refrigeration and air-conditioning equipment. Others work for construction companies, refrigeration or air-conditioning equipment manu-

facturers, contractors, and dealers. Some are employed by department stores, hotels, restaurant chains, factories, and other establishments large enough to require full-time maintenance men. Many mechanics have opened their own shops specializing in the repair of air-conditioning and refrigeration equipment.

Because of the widespread use of refrigeration and air-conditioning equipment, these workers are employed in all parts of the country. However, they are primarily employed in the large cities, where most of the large commercial and industrial establishments are located. New York, California, Illinois, Pennsylvania, and Texas lead in the employment of these workers.

Training and Other Qualifications

Many refrigeration and air-conditioning mechanics pick up the skills of their trade through on-the-job experience. They start as helpers and acquire their skills by working for several years with experienced craftsmen.

Apprenticeship training is another method of learning this trade. The apprenticeship programs, which generally last 4 or 5 years, include both practical experience and classroom instruction. Apprentices are given training in the installing and connecting of refrigeration equipment, gas lines, liquid lines, air control lines, and other kinds of piping. As their training progresses, they do layout and assembly work and are taught the planning aspects of the trade. Apprentices are given classroom instruction in mathematics, blueprint reading, compression refrigerating systems, heat transfer and insulation, electrical controls, and related subjects.

Employers prefer to hire high school graduates who have had courses in mathematics, mechanical drawing, and physics. Mathematical ability is an important qualification since workers in this trade are often required to make involved calculations in installing equipment. Mechanical aptitude and the ability to understand and work with electricity are other important qualifications.

Some technical institutes offer courses designed to help students qualify for positions as refrigeration servicemen and air-conditioning technicians. In these courses, students are taught to install, operate, maintain, and repair all types of refrigeration and air-conditioning equipment. They also take courses in electricity, mathematics, and drawing.

Although great strength is not essential, persons interested in entering this occupation should be in good physical condition because they are often required to lift and move some of the air-conditioning and refrigeration equipment.

Employment Outlook

The continued increase in the use of refrigeration and air-conditioning equipment in the Nation's factories, commercial building, and homes in the late 1950's and the 1960's is expected to create a demand for thousands of additional mechanics who can install, maintain, and repair refrigeration and air-cooling equipment. The number of refrigeration and air-conditioning mechanics is expected to grow at a faster rate than the labor force as a whole. In addition to the increased number of jobs resulting from the growth of this occupation, many openings will arise when workers die, retire, or transfer to other fields of work.

The use of refrigeration as a means of preserving food and other perishable items has grown tremendously in recent years. An increasing number of food items are preserved by refrigeration from the time they are picked in the fields or produced in factories until they reach the consumers' homes. Refrigerated storage warehouses, freight cars, trucks, and display cases have become the principal means of preserving perishable food in transit and in stores. The number of home refrigerators in use has increased at a rapid rate to keep up with this trend. From 1947 to 1954, the production of household mechanical refrigerators, 9.5 cubic feet and over, increased more than 1,000 percent. The relatively new and growing frozen foods industry requires a great amount of refrigeration equipment. During the 1947–54 period, the production of home and farm freezers (12.5–16.4 cubic feet) increased from about 45,000 to almost 360,000.

Refrigeration is also becoming increasingly important as part of the production process in the manufacture of such products as synthetic rubber, oil, high test gasoline, medicine, and drugs. Refrigeration is used to hold the temperature of the raw materials of these products at certain levels during processing in order to control their consistency, brittleness, tensile strength, or other

properties. A continued growth in the use of refrigeration in the 1956–66 decade is expected.

Air conditioning is becoming extremely important in industrial, commercial, and home use. Many manufacturers use air conditioning for the control of air temperatures and humidity and for the removal of dust from the air during the production process. Film, explosives, leather, paper, optical goods, ammunition, plastics, and electronics equipment are examples of products in which air conditioning is used at some time during the manufacturing process. The increasing use of air conditioning in offices, stores, and places of entertainment is indicated by the 150 percent growth in the production of air-conditioning units 2 tons and over from 1947 to 1954. Air conditioning for the home has had its greatest expansion in recent years, with more than a 3,000-percent increase in the production of home-type air conditioners between 1947 and 1954. The recent introduction of the heat pump, a combination cooling and heating unit for home use, is also expected to contribute to the growth of this occupation.

Earnings and Working Conditions

Although earnings data on a national scale are not available, the following wage information collected from a small number of employers in large cities on the East Coast shows that the earnings of refrigeration and air-conditioning mechanics compare favorably with those of other service mechanics. The rates of pay for skilled mechanics sometimes differ according to the size of equipment they work on, the type of work performed, and the type of establishment by which they are employed. For example, in January 1957 in some repair shops, journeymen who worked on equipment up to 5 horsepower were receiving \$2.75 to \$3 an hour; men working on equipment of more than 5 horsepower were generally being paid more than \$3 an hour. Men employed on the maintenance of commercial equipment generally received higher earnings than those employed on household equipment, even where the equipment was of the same size. Some mechanics working for distributors of commercial refrigeration and air-conditioning equipment, doing installation work, were generally receiving \$2 to \$3 an hour at the end of 1956. Apprentices usually start at about half the journeyman rate and receive increases after each 6-month period, moving up to 75 to 90 percent of the journeyman rate during the last 6 months.

Although most employers try to maintain the same work force throughout the year, some mechanics may be laid off during the winter months. Most mechanics work a 40-hour week. However, during the summer months they must often work overtime or at irregular hours to prevent financial loss and the inconvenience which can result from a breakdown of refrigeration or air-conditioning equipment. Time and one-half is paid for overtime in most shops.

Mechanics are sometimes required to work at high levels while installing new equipment. They may also work in awkward or cramped positions in order to reach motors or other parts of the equipment they are repairing. Hazards in this trade include those associated with the handling of heavy equipment and the possibility of torch burns.

Many refrigeration and air-conditioning mechanics belong to labor unions. Some of the more important unions in the trade are the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada; the International Brotherhood of Electrical Workers; and the Sheet Metal Workers' International Association.

Watch Repairmen

(D. O. T. 4–71.510)

Nature of Work

Watch repairmen (also known as watchmakers) do precise and delicate work in connection with repairing and adjusting watches, clocks, and other timepieces. The first step in restoring watches to good working condition is to remove the works from the case and, with the aid of a magnifying eyeglass, examine the various parts of the mechanism. Repairmen may then replace mainsprings, hairsprings, balance and other wheels, or broken jewels, and adjust improperly fitted wheels and other parts. They may also clean and oil the parts, replace dials, hands, watch crystals, and wristbands. The use of mass-produced parts which are interchangeable has considerably re-

Watch repairing requires patience and mechanical skill.

duced the need for making parts by hand. However, the factory-made parts must sometimes be adjusted to a particular watch to insure a "true" fit. In their work, watchmakers use small lathes and hand tools such as tiny pliers and screwdrivers.

Watchmakers who own or work in retail jewelry stores frequently repair jewelry as well as watches and may also perform a variety of sales and managerial duties. They may hire and supervise sales clerks, other watch repairmen, jewelers, and engravers; arrange window displays; and purchase and sell such items as silverware, china, and lamps.

Where Employed

Most watch repairmen work in retail jewelry stores (25,000 according to the 1954 Census of Business) or in separate watch repair shops, either as owners or employees. Many are employed by department stores and mail order houses or operate watch repair concessions in such establishments. Others work for trade shops (not usually open to the public) which repair watches for retail stores. A number work for jeweled-watch factories and importing firms or teach in watch repair schools.

The exact number of watch repairmen is unknown. Many of the functions of watch repairmen and jewelers overlap and it is difficult to separate these occupations. Furthermore, some people who are employed in other occupations do watch repairing on a part-time basis. According to the Census, a total of 45,000 jewelers, watchmakers, goldsmiths, and silversmiths were employed in 1950; it is estimated that at least half this number were engaged primarily in watch repairing.

Although watch repairmen work in all parts of the country, they are located chiefly in and near heavily populated cities. The greatest proportion of these workers are concentrated in New York City, but large numbers are also found in Chicago and Detroit.

Training and Other Qualifications

A few States—Iowa, Indiana, Louisiana, Minnesota, Oregon, Tennessee, and Wisconsin—require that watch repairmen obtain a license to work at the trade. Watch repairmen in these States must pass an examination designed to test their skill with tools and their knowledge of watch construction and repair. However, watchmakers in all States can demonstrate their ability by successfully passing an examination given by either the Horological Institute of America or the United Horological Association of America. The certificates awarded watchmakers who pass these examinations are widely recognized as indications of acceptable skill by employers throughout the country.

Many young people prepare for this trade through courses given in private watch repair schools. Some enter through vocational high school training. Others are trained in formal apprenticeship or other on-the-job training programs.

Nearly 50 watch repair schools were in operation in 1956. These schools generally had no specific educational requirements for entrance although most students were high school graduates. The length of time required to complete the course—usually 18 months to 2 years—is determined by the content of the course offered, the ability of the individual student, and whether attendance is full- or part-time. In most watch repair schools, a considerable amount of time is spent taking various types of watch movements apart and reassembling them, truing hairsprings, removing and replacing balance staffs and balance wheels, learning how to use a watchmaker's lathe, and cleaning watches. Students are required to furnish their own tools.

Important qualifications for success in this field are mechanical aptitude, finger dexterity, a sensitive touch, good vision (with or without glasses), and patience. For those interested in owning or working in a retail store, salesmanship and a good business sense are desirable.

Most beginners work in retail jewelry stores where they can get the experience needed to reach a high rate of output. Those with sufficient funds—about $1,000 to $1,500 is needed to cover the cost of a watch-timing machine and other tools and equipment—may open their own watch repair shops. Some watch repairmen gradually extend their services to include the sale of various items of jewelry and eventually establish retail jewelry stores.

Employment Outlook

Job openings for beginning watch repairmen are expected to be limited in the late 1950's. However, employment opportunities will be good for experienced repairmen who have established reputations for doing high quality work. Most vacancies will arise from the need to replace watchmakers who will die, retire, or transfer to other fields of work. In addition, a few new jobs will be available, particularly in small cities where business activities are expanding. However, a plentiful supply of watchmakers will probably be available to meet this moderate demand for their services. A considerable number—mostly veterans—were trained in the period immediately following World War II and, although the number of watchmaking schools had declined from about 125 in the early postwar period to fewer than 50 in 1956, the supply of watchmakers for repair work was still ample. There was, however, a brisk demand for trained watchmakers to fill light assembly jobs in industry or to repair instruments and electronic devices.

In the early 1960's and over the long run, little expansion in employment of watchmakers is likely. Factors which will tend to increase the demand for watchmakers appear to be offset by other factors which will operate to decrease it. The number of watches in use will probably continue to rise since many persons who do not now own watches will buy them and the trends toward owning more than one watch, wearing watches as costume jewelry, and buying more children's watches are expected to continue. The popularity of small watches, which need repair more frequently than large ones, and the introduction of more complicated timepieces—chronographs, calendar watches, and self-winding watches—will also help maintain a large volume of repair work. On the other hand, sales of inexpensive watches which can be replaced at a price as low as the cost of repairing them will probably continue to grow; competition from persons employed in other fields who repair watches in their spare time is expected to continue; and new types of watches are being developed which will require less repair.

Earnings and Working Conditions

Salaries of beginning watchmakers ranged from about $50 to $70 a week in 1956 depending on individual ability and the type and place of employment. Experienced watch repairmen who are in business for themselves usually earn considerably more than those working for a salary. However, earnings of those who are self-employed vary greatly according to the volume of repair work and, in the case of watchmakers who own retail jewelry stores, the volume of sales. According to a 1955 survey made by the Horological Institute of America, weekly earnings of experienced salaried watchmakers ranged from about $80 to $90 and those of self-employed watchmakers from $90 to $125.

Watchmakers frequently work longer than the standard 40-hour workweek. Average working hours in 1955 were reported to be about 47 a week for salaried watchmakers and about 56 hours for those who were self-employed. Although there may be some tendency toward eye strain, the work involves little physical exertion. This light, sedentary work is frequently recommended to certain handicapped and disabled workers.

Where To Go for More Information

Information on schools giving training courses acceptable to the trade, as well as on watch repairing as a career, may be obtained from:

Horological Institute of America,
P. O. Box 336, Annandale, Va.

United Horological Association of America, Inc.,
1901 East Colfax Ave., Denver, Colo.

MACHINING OCCUPATIONS

Almost every item produced by American industry contains metal parts or is manufactured by machines made of metal parts. Most of these metal parts are made to precise dimensions by a group of key craftsmen known as machining workers. These workers use stationary power-driven machines known as machine tools to form metal to desired shapes and sizes. Machining is the most common method of producing metal parts to specified sizes. It is 1 of the 5 principal methods of shaping metal. The others are casting, forging, rolling, and stamping.

Machining workers make up the largest occupational group in the metalworking trades. Their special skills make them one of the most important groups of craftsmen in our labor force. In late 1956, more than a million workers were employed in the skilled and semiskilled machining occupations as *all-round machinists*, *tool and die makers*, *machine tool operators*, *layout men*, and *setup men*.

Nature of Work

The principal job of metal machining workers is to operate machine tools. A machine tool is a power-driven machine which firmly holds both the piece of metal to be shaped and a cutting instrument, or "tool," and brings them together so that the metal is cut, shaved, ground, or drilled. In some cases, the cutting tool is moved and the metal is held stationary; in others, the metal is moved against a stationary tool. The most common types of machine tools are: lathes, grinding machines, boring mills, drilling machines, milling and broaching machines, shapers, and planers. The lathe is a machine in which the piece of metal, while revolving on a spindle, is cut to size by contact with a sharp metal cutting tool. Grinding machines are used to remove metal from internal and external surfaces by means of power-driven abrasive wheels. Boring mills and drilling machines are used to make holes in metal. Milling and broaching machines shape and remove metal with multiple cutting edge tools. Shapers and planers are machine tools which produce flat surfaces.

Accuracy is of prime importance for most metal machining work. Machines, engines, and other metal products are made of separate metal parts which must be made to precise dimensions by machining processes so that they are interchangeable and can be easily assembled for mass-production purposes. Metal parts are often machined to dimensions equal to about one-thirtieth the size of a human hair or one-tenth of one-thousandths of an inch (0.0001). Directions to the tool and die makers, the all-round machinists, the setup and layout men, and the skilled machine tool operators are generally given in the form of a drawing or blueprint upon which exact dimensions of the finished part are specified. Machining workers frequently use a precision measuring instrument known as a micrometer or "mike" to check the accuracy of their work against specifications.

In addition to the operation of machine tools, the skilled tool and die makers, machinists, and layout men spend a considerable portion of their time doing precision handwork such as laying out and assembling metal parts. After the separate parts have been machined, they use chisels, scrapers, and other small handtools in chipping, filing, and polishing the parts for exact fit in the final assembly.

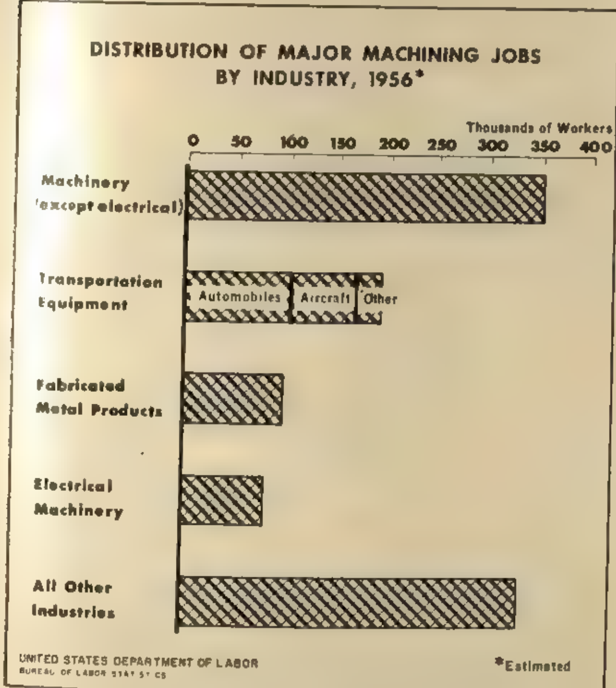
The all-round machinist is a skilled worker who can operate most types of machine tools. The most highly skilled machining job is that of the tool and die maker who specializes in making dies for use with presses and die casting machines, devices to guide drills into the metal, and special gages to determine whether the work meets specified tolerances. The largest number of machining workers are the skilled and semiskilled machine tool operators who run lathes, drilling machines, milling machines, grinders, and other machine tools. Setup men and layout men are skilled specialized workers employed in plants which produce large amounts of metal items. Setup men adjust machine tools so that semiskilled machine tool operators can run the machine and perform the proper machining operations. Layout men mark machining directions on metal so that an operator can perform the proper machining operations. A detailed discussion of the types of work

performed by workers in each of these machining occupations is presented later in this chapter.

Where Employed

About 600,000 machine tool operators, 265,000 machinists, 135,000 tool and die makers, and 45,000 setup men and layout men were employed in machining jobs in late 1956. More than three-fourths of these workers were employed in the metalworking industries, mostly in plants which manufacture machinery, transportation equipment such as automobiles and aircraft, fabricated metal products, and electrical machinery and equipment. (See chart 41.)

CHART 41



The remainder were employed in nonmetalworking establishments such as the repair shops of railroads and the maintenance shops of factories which make textiles, paper, glass, and chemicals. Although the number of machining workers in individual nonmetalworking plants is relatively small, these plants, as a group are an important source of employment. These industries are particularly important sources of employment for all-round machinists.

Machine tool operators, tool and die makers, and all-round machinists are employed in every State and in almost every city in the country. Nearly two-thirds of the machining workers are employed in New York, Ohio, Michigan, Illinois, Pennsylvania, California, New Jersey, and Massachusetts. (See chart 42.)

Training, Other Qualifications, and Advancement

Except for the semiskilled machine tool operating jobs, the common method of entering these occupations is through apprenticeship. The apprenticeship is a period of formal on-the-job training during which the new worker learns all the aspects of his trade. He is taught how to operate machine tools, and how to use handtools and measuring instruments. In addition to shop training, the apprentice is given classroom instruction in blueprint reading, mathematics, and other related subjects. In choosing apprentices, employers usually prefer young men who have a high school or trade school education. Some companies use aptitude tests to determine whether applicants for their apprenticeship programs have the necessary mechanical ability and the temperament suited to perform exacting work.

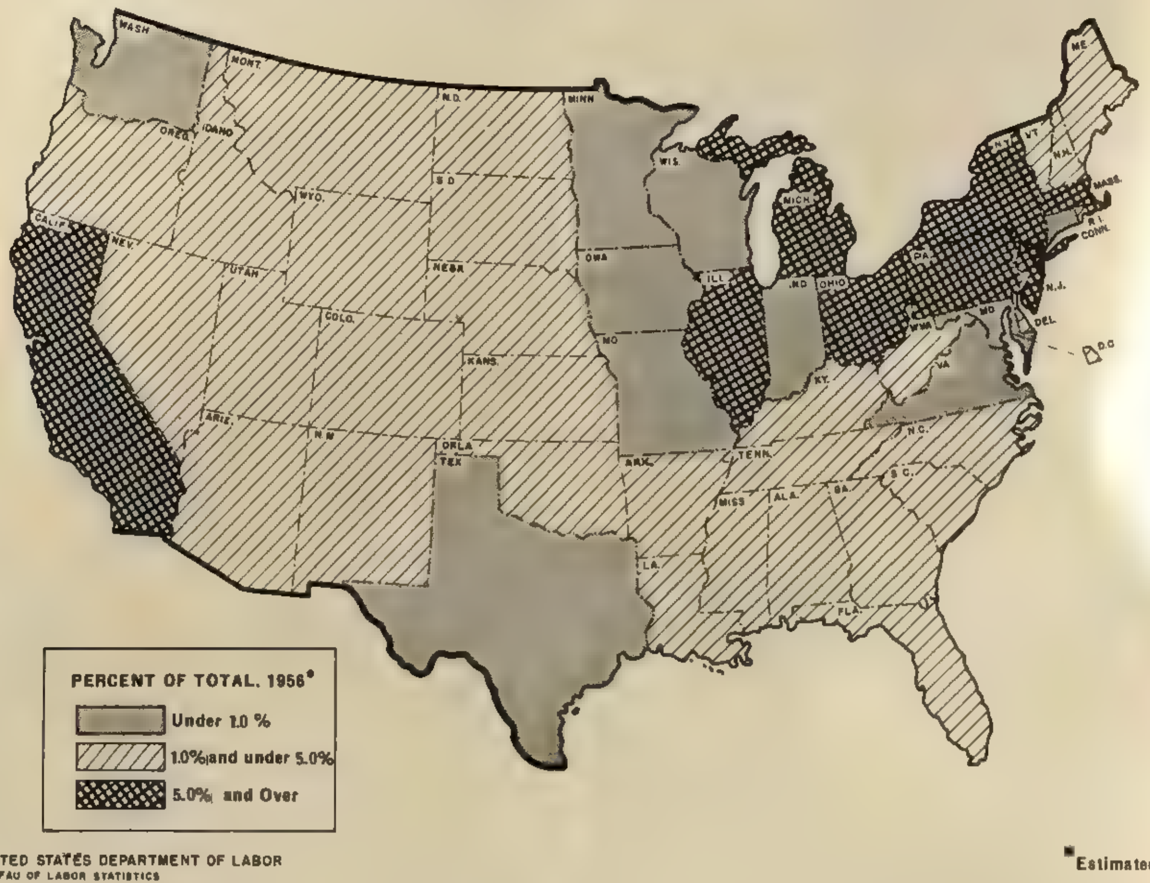
Most machine tool operators and some machinists and tool and die makers have picked up the skills of their trade informally through experience on-the-job. They generally start in the less skilled machine tool jobs and gain "know-how" while working with experienced craftsmen. They advance to the more skilled jobs after they acquire sufficient experience and knowledge. Some of these workers have helped to qualify themselves for the more skilled trades by taking courses in blueprint reading and shop mathematics in vocational schools.

Machining work is not physically strenuous. The machine tools do the actual cutting while the machining worker sets the machine, watches the controls, and checks the accuracy of the work. The workers, however, usually stand at their jobs most of the day and must be able to move about freely. Since continuous attention is required when the machine is in operation, the work may be rather tedious, especially on simple and repetitive machining jobs. However, where the work is varied and complex, and standards of accuracy are high, a worker can experience the satisfaction which comes to a capable and conscientious craftsman in a highly skilled trade.

Because the work is not physically strenuous, women are sometimes employed as machine tool

CHART 42

NEARLY TWO-THIRDS OF THE MACHINING JOBS ARE IN EIGHT STATES, 1956*



operators. For the most part, they are employed in the less skilled machining operations; practically none are working as tool and die makers or all-round machinists, and relatively few are employed as skilled machine tool operators.

There are several advancement opportunities for workers in these occupations. For example, skilled machining workers are able to advance to positions as foremen. Some skilled machining workers are able to move into administrative jobs in metalworking establishments. Some of the tool and die workers can advance to positions as tool designers. Another area of opportunity available to skilled machining workers is the possibility of opening their own tool and die establishments or machine shops.

Employment Outlook

There will be thousands of opportunities for new workers to get jobs as tool and die makers, all-round machinists, machine tool operators, layout men and setup men in the late 1950's and the 1960's. During this period, the number of workers employed in machining jobs is expected to rise significantly above the average level of employment in 1956 of more than a million. A large proportion of job openings will result from the need to replace workers who die, retire, or transfer to other fields of work.

Despite fluctuations caused by changing business conditions, the long range trend of employment in the metalworking industries has been upward. In recent years, employment of production workers in the metalworking industries, in which the majority of the machining workers are employed, has increased at a faster rate than production-worker employment in all manufacturing industries. Between 1947 and 1956, the average employment of production workers in the metalworking industries increased 14 percent as com-

pared with the 3-percent increase for all manufacturing industries. A rising population coupled with the growth of individual incomes should result in a continuing demand for metal consumer products such as automobiles, heating and cooking equipment, and home freezers. Anticipated continued expansion in expenditures for new plants and equipment should result in a growing volume of metal products used by industry such as machinery, engines, and pumps.

In the maintenance shops of nonmetalworking industries, long-run growth in machining employment is also expected. As a whole, these industries also have a general upward trend associated with rising population and higher national income. Moreover, the gradual mechanization of industry tends to expand the need for maintenance machining workers to keep mechanical equipment in good condition. Many of these nonmetalworking industries are much less affected by changes in general business conditions than are the metalworking industries, so that machining workers in the nonmetalworking industries tend to have fairly steady employment over the years.

Employment opportunities for machining workers will also be affected by defense activities. Although it is difficult to make long-range projections of defense expenditures, it appears likely that the Armed Forces during the late 1950's and the 1960's will increase their purchases of metal products.

Employment in the individual machining occupations is expected to increase at varying rates. Technological changes now developing are expected to result in a slower rate of employment growth for machine tool operators and setup men than is anticipated for tool and die makers and machinists. One of these developments is the use of automated machining lines in which machine tools are linked together for automatic production operations.

The numerical control of machine tools is another technological advance which, if widely introduced, could be a major factor in significantly affecting both the skill requirements and the employment of machine tool operators and setup men. The use of such controlled machine tools broadly involves the following sequence of operations: Engineers or draftsmen translate part dimensions and tolerances, cutter shapes and sizes, cutting paths and sequences, and other data into numbers, or codes representing numbers. The data are then punched onto tapes or cards which are inserted into electronic devices which automatically operate the machines. The machine-tool operator installs the tool, inserts and removes the workpiece, and changes the tapes or cards.

Numerically controlled machine tools would thus simplify the job of the machine tool operator as well as reduce machining time. Although it is still too early to measure the effect of this technological development, if numerically controlled machine tools should prove economical and be generally adopted, the growth of employment in machining occupations—particularly machine-tool operators—would be slowed. (A more detailed discussion of the employment outlook in individual machining occupations is presented in the individual sections later in this chapter.)

In addition to the expected rise in machining employment, replacement needs will create thousands of openings. Death and retirement of experienced men alone will provide about 20,000 openings annually during the 1956–66 decade. This will be a particularly important factor in the skilled machining occupations, which have a relatively high proportion of older workers. In the less skilled occupations, shifting into other lines of work is fairly common and many thousands of openings will arise in this way.

Earnings and Working Conditions

The earnings of skilled machining workers generally compare favorably with those of other skilled industrial workers. Tool and die makers are the highest paid workers in the machining group, and among the highest paid skilled workers in manufacturing. Detailed earnings information is presented in the discussions of the individual occupations.

Most of the shops in which machining workers are employed are fairly clean, well lighted, and free from dust. Safety instructions are an important part of job training. Because they work with high speed machine tools and sharp cutting instruments, workers in these occupations need good safety habits. Persons working around machine tools are prohibited from wearing loose fitting clothing and frequently wear protective goggles.

Machining workers are employed by companies which generally provide paid holidays and paid vacations. Other benefits available to some of the

workers in these occupations include life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and pensions.

The great majority of machining workers are members of unions. Among the labor organizations in this field are the International Association of Machinists; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; the United Steelworkers of America; and the Mechanics Educational Society of America.

Where To Go for More Information

Employment Outlook in Metalworking Occupations, Bulletin No. 1130, U. S. Department of Labor, Bureau of Labor Statistics, 1953, 38 pp., 7 charts, 14 illus., Superintendent of Documents, Washington 25, D. C., price 30 cents.

The National Tool & Die Manufacturers Association, 907 Public Square Building, Cleveland 13, Ohio, offers information on apprenticeship training, including Recommended Apprenticeship Standards for Tool and Die Makers, certified by the U. S. Bureau of Apprenticeship and Training. Many local offices of the State employment service, affiliated with the U. S. Employment Service, offer free aptitude testing to persons interested in determining their capacity to acquire the skills necessary for the all-round machinist and tool and die making trades. The State employment service also refers applicants for apprentice programs to employers. Apprentice information may also be secured from unions in this field. In many communities, applicants for apprenticeship are also received by labor-management apprenticeship committees. If no union is listed in the telephone book, an applicant may write to the following national headquarters and ask them to refer the letter to their nearest branch.

International Association of Machinists,
1300 Connecticut Ave., NW., Washington 6, D. C.

International Union, United Automobile, Aircraft & Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit 14, Mich.

International Union of Electrical, Radio and Machine Workers,
734 15th St., NW., Washington 5, D. C.

Persons interested in opening their own metalworking business should consult:

Establishing and Operating a Metalworking Shop, U. S. Department of Commerce, 1949, Superintendent of Documents, Washington 25, D. C., price 60 cents.

All-Round Machinists

(D. O. T. 4–75.010 and .120)

Nature of Work

The all-round machinist is a skilled metal worker who shapes metal parts by using machine tools and hand tools. Variety is the main feature of his work. His training and experience enable him to plan and carry through all the operations needed in turning out a machined product and to switch readily from one kind of product to another. An all-round machinist is able to select the proper tools and material required for each job and can plan the cutting and finishing operations in their proper order so he can complete the finished work according to blueprint or written specifications. He makes standard shop computations relating to dimensions of work, tooling, feeds, and speeds of machining. He often uses precision-measuring instruments such as micrometers and gages to measure the accuracy of his work to thousandths of an inch.

These skilled workers must be able to set up and operate most types of machine tools. After completing machining operations, they may finish the work by hand, using files and scrapers. They may assemble the finished parts with wrenches and screwdrivers. The all-round machinist must also know the composition of metals so he can "heat treat" cutting tools and parts by heating and quenching them to improve machinability. His wide knowledge of shop practice and the working properties of such metals as steel, cast iron, aluminum and brass, and his understanding of what the various machine tools do, make it possible for him to turn a block of metal into an intricate, precise part.

Machinists employed in maintenance departments to make or repair metal parts of machines and equipment must also have a broad knowledge of mechanical principles. They are sometimes required to adjust and test the parts they have

made or repaired for proper operation in a machine.

Where Employed

Almost every factory using a substantial amount of machinery employs maintenance machinists to keep its mechanical equipment operating. The majority of the 265,000 machinists are employed in the maintenance shops of plants in a wide variety of industries such as the railroad, textile, automobile, and printing industries. Many are employed in Navy yards and other installations of the Federal Government. Some machinists are employed in production jobs in metalworking factories where large quantities of identical parts are produced, as well as in machine shops where a limited number of varied products are made.

One of the advantages of the machinist occupation is that workers in this occupation are employed in almost every locality and industry because their skills are required to maintain all types of machinery. The largest number of machinists jobs are found in the States where the metalworking industries are concentrated. About half of the machinists work in the metalworking States—New York, Pennsylvania, Ohio, Illinois, California, Michigan, Massachusetts, and New Jersey.

Training, Other Qualifications, and Advancement

According to most authorities, a 4-year apprenticeship is the best way to learn the machinist trade. Many machinists, however, have qualified without an apprenticeship by picking up the trade over years of varied experience in machining jobs.

A young person interested in becoming a machinist should be mechanically inclined and temperamentally suited to do exacting work. A high school or vocational school education is desirable preparation for machinist training and is required by many employers. Courses in mathematics and science are helpful to the apprentice applicant.

A typical machinist apprentice program lasts 4 years and consists of approximately 8,000 hours of shop training and 576 hours of related classroom instruction. Shop training includes the learning of proper speeds and the operation of the various types of machine tools. The apprentice is also taught chipping, filing, hand tapping, dowel fitting, riveting, and other hand operations. In the classroom, the apprentice studies blueprint reading, mechanical drawing, shop mathematics, and shop practices.

The increasing use of electronic controls and hydraulic operation of machine tools is affecting the skill requirements for all-round machinists. If possible, young persons entering this occupation should acquire a knowledge of electronics and hydraulics in addition to their machinist training so that they will be prepared for future technological developments.

A machinist who has just finished his apprentice training is often assigned the job of operating a single type of machine tool. With additional experience, he may then be assigned to jobs requiring him to operate several types of machine tools as well as to perform hand operations. Some journeymen machinists, however, remain skilled machine tool specialists and do highly skilled work with one type of machine tool.

Numerous promotional opportunities are available to all-round machinists. Many advance to foreman of a section or to other supervisory jobs. With additional training, some develop into tool and die makers. Others are successful in opening and operating machine shops of their own.

Employment Outlook

There will be many opportunities for new workers to obtain jobs as machinists in the late 1950's and the 1960's. Some of these opportunities will develop because of the expected increase in employment in this occupation. This is a relatively large occupation and thousands of new workers will also be needed each year to replace those workers who die, retire, or transfer to other fields of work. Deaths and retirements alone will result in about 7,000 job openings annually during the 1956–66 decade.

The employment of machinists is expected to increase both in the nonmetalworking and metalworking industries. American industry is continuing to use a greater volume of more complex machinery and equipment. Plants with highly mechanized operations will require more machinists. As manufacturing operations become more interrelated by the combining of automatic machines, breakdowns become more costly and time consuming. Therefore, maintenance and repair activities become far more important and the employment of skilled machinists becomes more necessary to insure continuous production.

Earnings and Working Conditions

The earnings of all-round machinists compare favorably with other skilled factory workers. All-round machinists employed in maintenance jobs are generally paid on an hourly basis. Those working in production jobs are usually paid an incentive rate based upon their output.

A Bureau of Labor Statistics wage study of the machinery manufacturing industries in 21 selected areas in the winter of 1955–56 gives an indication of the general level of earnings of production machinists. Average straight-time hourly earnings of production machinists, available in 15 of the 21 areas surveyed, ranged from $1.88 in Worcester to $2.41 in the Los Angeles–Long Beach area, as shown below:

Boston	$2.14
Hartford	2.12
Worcester	1.88
Buffalo	2.22
Newark–Jersey City	2.33
New York City	2.35
Philadelphia	2.34
Baltimore	2.15
Dallas	2.02
Houston	2.34
Cleveland	2.33
Denver	1.94
Los Angeles–Long Beach	2.41
Portland (Oreg.)	$2.34
San Francisco–Oakland	2.28

According to the Bureau of Labor Statistics occupational wage surveys in 21 selected areas in 1955–56, the average straight-time hourly earnings of all-round machinists in maintenance jobs ranged from $1.84 in Lawrence, Mass., to $2.64 in Detroit, Mich.

Machinists must follow strict safety regulations when working around high speed machine tools. The greater use of safety goggles and other protective devices in recent years has reduced the accident rate for these workers.

Most of the companies which employ machinists provide paid holidays and paid vacations. Some machinists may also receive benefits such as life insurance, hospitalization, medical and surgical insurance, sickness and accident insurance, and a retirement pension.

Many machinists belong to unions. Among the labor organizations which include machinists in their membership are the International Association of Machinists; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; the International Union of Electrical, Radio and Machine Workers; and the United Steelworkers of America.

Tool and Die Makers

(D. O. T. 4–76.010, .040, and .210)

Nature of Work

Tool and die makers are highly skilled workers who make the tools and dies used in shaping and forming metal parts. Tool makers specialize in producing the jigs and fixtures—the devices required to hold metal while it is being shaved, stamped, or drilled. They also make gages and other measuring devices needed in the manufacture of precision metal parts. Die makers construct the dies—the metal forms for shaping metal by stamping and forging operations. They also make the metal molds used in die-casting and in molding plastics. Another important part of the job of tool and die makers is the repair of dies, gages, jigs, and fixtures. Some tool and die makers also do part of the actual tool and die designing.

Tool and die makers use many types of machine tools and a wide variety of precision measuring instruments. They must have a broad knowledge of the machine properties of common metals and alloys. Above all, tool and die makers must have a broader knowledge of all machining operations, shop practices, mathematics, and blueprint reading than any of the other machining workers. In addition, they must be able to work to closer tolerances than other machining workers, and usually do more precise hand work. These requirements, plus the specialization in tools and dies, distinguish these craftsmen from the other machining workers.

Where Employed

The 135,000 tool and die makers working in 1956 were primarily employed in metalworking industries. The automobile industry, which is the largest single employer of these craftsmen, employed more than 20,000 tool and die makers. The

Apprentice diemaker grinding down a surface on a die for a small part.

thousands of tool and die jobbing shops, which make tools, dies, jigs, fixtures, and other machine tool accessories for other companies on individual order, together employ nearly as many tool and die makers as does the automobile industry. Many tool and die makers work in machinery plants, such as those making farm machinery and tractors, machine tools, and industrial machinery and equipment. Companies manufacturing electrical machinery, aircraft, and fabricated metal products are other important employers of tool and die makers. These skilled craftsmen are also employed in the nonmetalworking industries. For example, the plastics products industry employed about 3,000 tool and die makers in 1956 to make metal molds.

More than 50 percent of the tool and die makers are employed in the 4 States of Michigan, Ohio, New York, and Illinois, with Michigan alone having almost one-fourth of the Nation's tool and die makers. Other States ranking high in the employment of these skilled craftsmen are Pennsylvania, Connecticut, New Jersey, and California. Detroit, Clevěland, and Chicago are important job centers for tool and die makers.

Training, Other Qualifications, and Advancement

Tool and die making requires rounded and varied training and experience which is generally obtained through formal apprenticeship or its equivalent in other types of on-the-job training. Since this is the most exacting metal machining job, persons planning to enter this trade should have considerable mechanical ability, finger dexterity and a liking for painstaking work. In selecting apprentices, most employers prefer young men with high school or trade school education. Some employers test apprentice applicants to determine their mechanical aptitudes and their ability to work with mathematics.

A tool and die apprenticeship ordinarily lasts 4 or 5 years. Most of the time is devoted to practical shop training, but some classroom work is also part of the training program. During the shop training period, the apprentice learns to operate the major machine tools, such as lathes, milling machines, grinders, and shapers. He is also taught the use of handtools, such as scrapers and files, for the fitting and assembling of tools, dies, gages, jigs, fixtures, and machines. Tool and die makers must also master heat treating and other metalworking processes. Related classroom training in shop mathematics, shop theory, mechanical drawing, tool designing, and blueprint reading is also given to apprentices. After apprenticeship, a number of years of experience as journeyman is often considered necessary to qualify for the more difficult tool and die work. Some companies separate their toolmaking and diemaking apprenticeship programs. The following is an example of the shop training and related instruction given to an apprentice tool and die maker:

Schedule of shop training	*Approximate hours*
Total	8,000
Tool crib	200
Drill press	500
Shaper	600
Milling machine	900
Lathes (engine and bench)	1,000
Grinders	1,400
Filing machine	200
Contour cutting	100
Heat treating	100
Benchwork	3,000
Miscellaneous machines	---

Schedule of related instruction

Mechanical drawing and shop sketching; elementary physics; science of metals (metallurgy); elementary economics; blueprint reading; shop mathematics; elements of tool and die design.

A recent study by the Bureau of Labor Statistics indicated that many metal machining workers have become tool and die makers without going through a formal apprenticeship program. These men, after years of experience as machine tool operators and with supplemental vocational or correspondence school training, have developed into all-round workers who are able to perform almost any metal machining operation including tool and die making with a high degree of skill.

The increasing complexity of modern machinery and metalworking equipment is raising the technical and mental skill requirements for tool and die making. A knowledge of mathematics, the basic sciences, electronics, and hydraulics will give young persons entering this occupation greater opportunities to further their careers.

An early investment in a thorough training for this occupation may lead to better paying jobs in the future. Men with tool and die training are often selected for supervisory and administrative positions in industry. Many tools and diemakers become tool designers. Others may open their own small tool and die jobbing shops.

Employment Outlook

An increasing number of tool and die makers will be needed in the late 1950's and the 1960's as a result of the anticipated expansion of metalworking activity. In addition, many openings will be created by those workers who die, retire, or transfer to other fields of work. Deaths and retirements alone will create about 3,000 job openings annually in the 1956–66 decade.

The anticipated expansion in the automobile, aircraft, machinery, and other metalworking industries will result in a continued increase in the employment of tool and die makers. The skills of these key workers are needed to make the dies and tools used to produce the thousands of identical metal parts made in these industries.

Unlike most other machining workers whose employment may be adversely affected by future technological changes, more tool and die makers will be needed to help put these technological developments into effect. For example, more tool and die makers are needed to make and repair the dies and holding devices used in the automated machining lines in the mass-production industries.

Tool and die makers, as a group, have a longer working life than many other workers in the labor force. Their jobs require extensive skill and knowledge which can be acquired only after years of experience. These skilled craftsmen also have more job mobility than most other skilled workers. They can transfer readily from one metalworking industry to another. Furthermore, they have greater occupational mobility than other workers. For example, skilled tool and die makers can transfer to jobs as instrument makers or machinists.

Earnings and Working Conditions

Tool and die makers are the highest paid metal machining workers. Although no national hourly earnings data are available for tool and die makers, information collected from a small number of Midwest and East Coast employers, in early 1956, indicates hourly earnings generally range from $2.50 to $3.50.

Because tool and die makers do precision work, the areas in the plants or shops in which they work are generally clean and well-lighted. Tool and die makers stand part of the time when they are operating machine tools. At other times they do hand work at benches. Sometimes they go into the plant to test, at the machines, the tools and dies they have made.

Good safety habits are necessary for tool and die makers because they work with high speed machine tools and sharp cutting instruments. The use of safety devices has reduced the injury rate for machining workers in recent years.

Most tool and die makers are members of such unions as the International Association of Machinists; the International Union of Electrical, Radio and Machine Workers; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; the United Steelworkers of America; and the Mechanics Educational Society of America. Labor-management contracts covering these workers often provide benefits, such as life and health insurance, and pension plans.

Machine Tool Operators

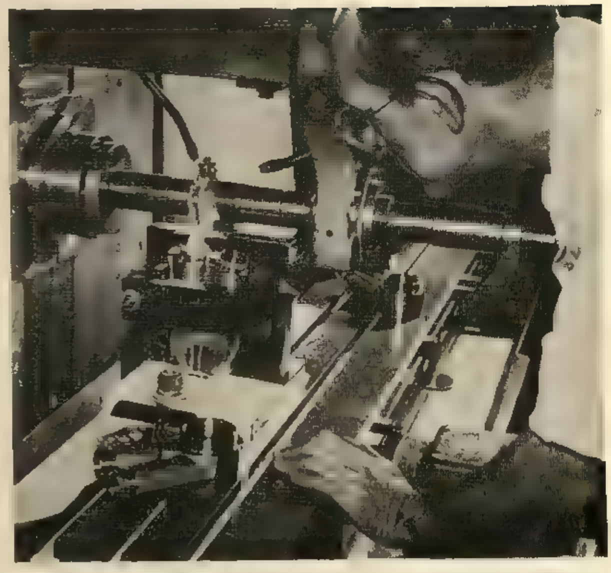
(D. O. T. 4–78.000 through .589 and 6–78.000 through .589)

Nature of Work

Machine tool operators shape metal to precise dimensions by the use of machine tools. However, unlike the all-round machinists who are expected to be able to operate all machine tools, machine tool operators are generally limited to the operation of 1 or 2 machine tools. There is a wide range of skills among the workers who operate machine tools. Many operators are essentially machine tenders who perform simple operations which can be learned quickly. In contrast, other machine tool operators are much more skilled and can perform complex machining operations. The work of these skilled machine tool operators is similar to that of the all-round machinist, except that it is often limited to a single type of machine and little or no hand fitting or assembly work is performed.

The skilled machine tool operator works from blueprints or layouts in order to plan the correct sequence of operations. He sets up the machine for each machining operation by adjusting feed and speed controls and he selects the proper cutting tools. Adjustments may be necessary during the machining operations and frequent changes in setup are often required. Therefore, the skilled operator must be adept in using all the special attachments of his machine. Upon completion, he checks the finished work with micrometers, gages, and other precision measuring instruments to see whether all specifications have been met. The skilled machine tool operator may also be required to select proper coolants such as cutting and lubricating oils used to keep the metal and tools from becoming too hot during the machining operation.

The majority of machine tool operators are much less skilled than the specialists described above. Semiskilled operators do repetitive rather than varied work. A typical assignment of the semiskilled operator is to place the rough metal stock into an automatic machine tool on which the speeds, feeds, and operation sequence have been set. He watches the repetitive operations of the machine and calls for his supervisor when trouble arises. Specially prepared gages which simplify measurement are often used by a semiskilled operator. The operator with limited training may make minor adjustments to keep the machine tool in operation, but he depends on more skilled men for major adjustments.



Metals are shaped to precise dimensions on various machine tools, including the milling machine operated by a machine tool operator as shown here.

Lathes, drill presses, boring machines, grinding machines, milling machines, planers, and shapers are among the important machine tools used by machine operators. Both skilled and semiskilled operators are given a job title based upon the kind of machine they operate, such as engine lathe operator, milling machine operator, and drill press operator.

Where Employed

Machine tool operators are primarily employed in metalworking factories where metal parts for automobiles, aircraft engines, machinery, and other metal products are manufactured on a mass-production basis. The size of the plant, the organization of the work sequence, and the extent of the simplification of machining operations determine whether employers will use semiskilled or skilled operators. Because of their limited training, few semiskilled operators can be used in either the maintenance departments of a plant or in a machine shop which does small job lot production work on a contract basis. Skilled machine tool

operators, on the other hand, because their greater skills give them wider job opportunities, are employed in production, job, or maintenance shops, and in tool rooms.

Machine tool operator jobs are found in greatest number where the metalworking industries are located. The six States leading in the employment of operators are New York, Pennsylvania, Ohio, Illinois, California, and Michigan.

Training, Other Qualifications, and Advancement

Most machine tool operators learn their skills on the job. After a new worker is hired, he usually starts his training by observing a skilled operator at work. When the learner is put in charge of a machine, he often continues to be supervised by a more experienced worker. In most cases, the new worker learns on the job to read measuring instruments and to make the elementary computations needed for shop work.

As the operator acquires experience and learns the various aspects of machine tool operation, and as he becomes proficient in reading blueprints and planning the sequence of machining work, he may move into the skilled operator category. Many all-round machinists and tool and die makers began their careers as operators.

Some of the larger companies conduct formal training programs for their new employees. A combination of classroom and on-the-job instruction is offered to acquaint the new worker with the details of machine tool operation and machining practice. The length of time required to become a machine tool operator depends, to a great extent, on individual ability. Semiskilled machine tool operators generally learn their jobs within a few months. A period of 1½ to 2 years of on-the-job training and experience is generally required to become a skilled machine tool operator. Some of the more highly skilled machine tool operators' jobs are filled by men who have completed machinist apprenticeships.

Although there are no special educational requirements for semiskilled operator jobs, prior knowledge of mathematics and blueprint reading will improve the job opportunities for young persons seeking such jobs. In hiring unskilled operators, employers also often look for persons with mechanical aptitude who have had some experience working with machinery.

Employment Outlook

The anticipated increase in employment in the metalworking industries in the late 1950's and the 1960's is expected to result in a growing demand for machine tool operators. In addition to the demand created for these workers by the growth of the metalworking industries, the need to replace those workers who die, retire, or transfer to other fields of work will also create a considerable number of job opportunities each year for new workers to enter this occupation.

Technological developments, however, may affect both the number and skill requirements of machine tool operators. The continued development and use of faster and more versatile automatic machine tools will result in greater output per machine tool operator.

If the use of numerically controlled machine tools should become widespread, this could slow up somewhat the anticipated increase in the employment of machine tool operators. In this method of machining, part dimensions, tolerances, cutter shapes and sizes, cutting paths and sequences are translated into numbers or codes representing numbers. The numbers are punched on cards or tapes which can be inserted into electronic devices which then run the machine tool automatically. This method reduces and simplifies the work of the machine tool operator.

However, as with the technological changes of the past, the electronic control of machine tools by punched tapes or cards will probably be introduced very gradually and have little immediate effect upon the employment and skill requirements of machine tool operators. Those workers who have a thorough background in machining operations, mathematics, blueprint reading, and a good working knowledge of the properties of metals should be able to adjust with little difficulty to the future technological changes anticipated in the machining field.

Earnings and Working Conditions

Machine tool operators are paid on an hourly rate or incentive basis, or on the basis of a combination of both methods of wage payments. Operators employed in production shops are usually classified as class A, classs B, and class C operators according to their skill level. Class A

machine tool operators are the most highly skilled and are paid the highest rates. According to a wage study of the machinery manufacturing industry conducted by the Bureau of Labor Statistics in selected areas in 1955–56, the average straight-time hourly earnings for drill press, engine lathe, and milling machine operators were as follows:

City	Drill-press operators, single or multiple spindle			Engine-lathe operators			Milling machine operators		
	Class A	Class B	Class C	Class A	Class B	Class C	Class A	Class B	Class C
Boston	$2. 19	$1. 82	$1. 56	$2. 02	$1. 84	--------	$2. 23	$1. 89	$1. 59
Buffalo	--------	2. 04	1. 67	2. 19	1. 89	--------	2. 16	2. 06	--------
Chicago	2. 21	2. 13	1. 84	2. 42	2. 07	--------	2. 48	2. 16	1. 92
Cleveland	2. 43	2. 13	1. 80	2. 34	2. 33	$1. 90	2. 41	2. 14	2. 01
Dallas	--------	1. 43	1. 26	1. 97	1. 78	1. 62	1. 91	1. 56	--------
Denver	--------	1. 86	--------	2. 24	1. 89	--------	--------	1. 96	--------
Detroit	--------	2. 14	2. 05	2. 88	2. 29	--------	2. 88	2. 28	2. 05
Hartford	1. 97	1. 77	1. 86	2. 19	1. 95	--------	2. 11	1. 95	1. 85
Houston	2. 14	--------	--------	2. 39	--------	--------	2. 29	--------	1. 97
Los Angeles–Long Beach	--------	1. 89	1. 66	2. 34	2. 06	1. 79	2. 28	2. 05	1. 76
Milwaukee	2. 36	2. 19	2. 01	2. 38	2. 23	2. 01	2. 44	2. 30	2. 01
Minneapolis–St. Paul	--------	1. 94	1. 61	2. 25	--------	--------	2. 25	--------	1. 77
Newark–Jersey City	2. 09	2. 03	--------	2. 24	--------	1. 65	2. 31	1. 98	--------
New York City	2. 20	1. 95	1. 58	2. 28	1. 93	1. 59	2. 38	2. 00	1. 63
Philadelphia	2. 16	1. 89	1. 70	2. 36	1. 98	1. 66	2. 42	2. 23	--------
Pittsburgh	--------	2. 22	--------	2. 43	2. 14	--------	2. 35	2. 27	2. 26
Portland (Oreg.)	--------	2. 04	--------	2. 26	--------	--------	2. 25	2. 11	--------
St. Louis	--------	2. 01	1. 69	2. 58	2. 06	--------	2. 52	2. 04	1. 93
San Francisco–Oakland	2. 23	1. 99	--------	2. 27	--------	--------	2. 28	--------	--------
Worcester	2. 06	1. 86	--------	2. 04	1. 87	--------	2. 06	1. 98	1. 68

Machine tool operators must follow safety precautions. They are required to wear protective goggles and to avoid the wearing of loose-fitting garments when working around high speed machine tools. Increasing emphasis upon safety regulations has reduced the accident rate for these workers in recent years.

Many machine tool operators are members of unions. Among the labor organizations active in the factories where operators are employed are the International Association of Machinists; the International Union of Electrical, Radio and Machine Workers; the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America; and the United Steelworkers of America. Most labor-management contracts provide for health insurance, life insurance, and pension benefits.

Setup Men (Machine Tools)

(D. O. T. 4–75.160)

Nature of Work

The setup man, often called a machine tool job setter, is a skilled specialist employed in plants and machine shops which do machining in large volume. His job is to install cutting tools and adjust the controls of machine tools so that they can be run by semiskilled operators. He must be able to explain the operations to be performed and show how machining accuracy can be checked.

The usual practice is to assign a setup man to a number of machine tools, which are often of one type, such as the turret lathe. Working from drawings, blueprints, written specifications, or job layouts, he determines feeds, speeds, tooling, and operation sequence, and adjusts guides, stops, and other controls accordingly. After setting up a machine, he may make trial runs and adjust the machine and tools until the parts produced conform to specifications. The machine is then turned over to a semiskilled operator. During the machining operation, the setup man makes adjustments for the machine tool operator so that accurate production is maintained.

Where Employed

Most setup men are found in factories in metalworking industries such as the machinery, the automobile, and the aircraft industries which employ large numbers of semiskilled machine tool operators. These highly skilled workers are usually not employed in maintenance shops or in small jobbing shops. Setup men are located mostly in the States of Michigan, Ohio, Connecticut, and Illinois.

Training and Other Qualifications

To become a setup man, it is usually necessary first to qualify as an all-round machinist or as a skilled machine tool specialist, because a setup man must be thoroughly trained in the operation of one or more machine tools. He must also learn to read blueprints and make computations in selecting speeds and feeds for machine tools. He must learn to explain to a semiskilled machine tool operator the operations to be performed and how to check machining accuracy. Above all, a setup man must learn the sequence of operations so that the metal parts being produced by the semiskilled operators under his supervision will be made exactly to specifications. Jobs for setup men are usually filled from within the shop by promotion or reassignment rather than through hiring from the outside.

Employment Outlook

There should be a moderate increase in the employment of setup men in the 1956–66 decade. This is a small occupation which will provide a relatively small number of job opportunities for new workers in the next decade.

The widespread use of numerical control machine tools would limit employment growth in this occupation. However, as with other technological changes, punched tape and card controls will probably be introduced gradually and have little immediate effect upon the employment of setup men.

Layout Men

(D. O. T. 4–75.140)

Nature of Work

The layout man is a highly skilled specialist who makes guidemarks on metal before it is machined to indicate to machine tool operators the kind of machining needed. Working from blueprints, drawings, or written specifications, the layout man marks instructions, guidelines, and reference points on rough castings, forgings, or metal stock. He uses a wide assortment of instruments, including the scriber, with which he marks lines on the surface of the metal; the center punch to indicate the centers on the ends of metal pieces to be machined or drilled; the keyseat or box rule for drawing lines and laying off distances on curved surfaces; dividers, for transferring and comparing distances; L- or T-squares for determining right angles; and calipers and micrometers for accurate measurement. Not only must the layout man work with extreme accuracy, but he also must be familiar with the operation and uses of each of the standard machine tools.

COURTESY OF U. S. NAVAL GUN FACTORY

Layout man marking lines and reference points on a casting with a surface gage to guide the machine tool operator.

Where Employed

Layout men work primarily in the mass-production metalworking industries employing large numbers of machine tool operators. Most of the layout men work in plants producing electrical machinery and transportation equipment. Many are employed in New York, Pennsylvania, Ohio, Illinois, and California.

Training and Other Qualifications

From 6 to 10 years is required to develop the skill for this exacting job. The training includes the machinist apprenticeship or the equivalent preparation needed to learn all machine tool operations, the machining qualities of metals, and the proper sequence of machining operations.

A layout man must be well trained in mathematics and blueprint reading. He must also be adept in using a wide variety of precision measuring tools.

Mechanical ability and the inclination to do painstaking work are important qualifications for layout men. Above all, layout men must learn to visualize the sequence of machining operations so they can correctly lay out in detail the plan of work for machine tool operators.

Employment Outlook

Employment is expected to increase slowly in this small occupation in the late 1950's and the 1960's. The anticipated large increase in metalworking activity—particularly in plants employing large numbers of machine tool operators—will result in an increased employment of layout men. Replacement needs will also provide a small number of job opportunities for skilled machinists to be promoted to jobs as layout men.

FOUNDRY OCCUPATIONS

Foundries and Their Workers

Foundry work is one of the principal metalworking fields and one of the largest sources of employment for trained workers in manufacturing. In mid-1956, about 460,000 persons had jobs in the Nation's 5,000 foundries. Many of these workers were employed in skilled occupations. Earnings in many of the unique foundry occupations are above the average for factory work as a whole.

Nature and Location of Foundries

Foundries are workplaces that use the casting method to make metal products. Metal casting consists of preparing a mold containing a cavity in the shape of the product to be duplicated, and then melting metal and pouring it into the mold. The molten metal is allowed to cool and harden, taking the shape of the mold cavity. Casting is one of the major metal shaping methods, among which are machining, forging, stamping, and rolling and drawing. It provides an economical means of forming a wide range of intricate shapes possessing considerable strength and rigidity. Castings range in size from a few ounces to many tons. The bulk of the casting output is used as component parts of a great variety of products. Among the articles which are cast are automobile cylinder blocks, machine-tool bases, railroad car wheels, ship propellers, water mains, radiators, bathtubs, washing-machine agitators, and cooking utensils.

A number of different metals and alloys are cast. Foundries usually specialize in casting 1 or 2 metals, since somewhat different kinds of equipment and methods are used for the various metals. Most castings are made from ferrous metals; about three-fourths of all foundry workers are employed in ferrous foundries. In this group, most of the workers are employed in plants that cast gray iron. Steel and malleable iron are the other important types of ferous metals which are cast. More than 100,000 workers were employed in mid-1956 in foundries or foundry departments that primarily cast nonferrous metals. Copper alloys (brass and bronze), aluminum, magnesium, and lead are the principal nonferrous metals which are cast. Most foundry workers can transfer from casting one type of metal to another without much additional training.

Foundries differ greatly in the way their production is organized. *Production* foundries make large quantities of identical castings and can, therefore, take advantage of mass-production methods. These shops are, as a rule, highly mechanized. *Jobbing* foundries, on the other hand, make castings in a variety of shapes, usually in limited quantities. Often they cannot efficiently mechanize their production. Consequently, they utilize more hand techniques and generally employ a greater proportion of skilled workers than do production foundries.

The distinction between production and jobbing foundries is not always sharply defined, as production foundries often do some jobbing work and jobbing foundries may carry on some semiproduction operations. Jobbing foundries are usually separate establishments, "independent" or "commercial" shops, which make castings on order for other firms. About two-thirds of all foundry jobs are in independent foundries. Many production foundries are integrated foundries, that is, departments of plants that manufacture finished products, such as automobiles or farm machinery.

Foundries range in size from small shops employing a handful of workers to huge plants having several thousand employees. About 40 percent of the workers in independent foundries are employed in plants with fewer than 250 workers, 35 percent are in shops employing 250 to 999 workers, and 25 percent are in foundries with more than 1,000 workers. The size of the foundry often influences the production organization, the degree of mechanization, and the skill requirements of its workers. Large foundries are usually more mechanized than small foundries and have a relatively smaller percentage of skilled workers.

Although every State has some foundry jobs, most of them are in the Midwestern and Northeastern States. Foundries tend to be near the

great concentrations of metalworking industries for which they produce castings. The States with the most foundry jobs are: Ohio, California, Pennsylvania, Illinois, and Michigan. Foundry jobs also appear in substantial numbers in other parts of the country. Alabama, for example, has many foundry workers.

Foundry Processes

There are five principal casting methods based primarily on different types of molds. By far the most common method is green sandcasting. In this method, sand composed chiefly of silicon and clay is packed (in a container called a flask) around a pattern (a model of the object to be cast). The pattern is withdrawn and molten metal is poured into the mold cavity to form the desired metal shape. The sand mold can be used only once.

A second method is based on permanent molding in which a metal mold, which can be used many times, takes the place of the sand mold. Metal molds are used chiefly for casting nonferrous products. They are utilized in centrifugal casting, in which the mold is rotated rapidly while the molten metal is poured into it. This process is especially appropriate for casting articles of cylindrical form like pipes and gun barrels.

Precision investment casting, a third method (often known as the "lost-wax" process) utilizes ceramic molds. In this method, a wax pattern is coated with refractory clay. After the coating hardens, the wax is melted and drained out leaving a mold cavity into which the casting metal is poured. Castings obtained from these molds have high dimensional accuracy and need little machining.

Shell molding, a fourth process, was introduced after the end of World War II and is increasing greatly in importance. In this process, resin-bonded sand shells made from master metal patterns replace green sand molds. The advantages of this method include greater precision, good surface finish of the casting, and lower unit cost in quantity production.

Die casting is a machine process in which molten metal is forced under high pressure into steel dies from which the resulting castings are automatically ejected. Because die casting is a separate and distinct process, die-casting jobs are excluded from the following estimates of foundry employment and from further discussion in this chapter.

Foundry Occupations

As shown in the table below, about 85 percent of the approximately 460,000 workers who had jobs in foundries or foundry departments in mid-1956 were employed in plant occupations. More than half of the plant workers had jobs which are not found elsewhere in industry. It is these occupations that are chiefly discussed in this chapter of the Handbook.

Occupational group	Distribution of foundry employment
	Percent
Total employment	100. 0
Nonplant occupations	15. 3
Professional and technical	3. 7
Managerial	3. 3
Clerical and sales	8. 3
Plant occupations	84. 7
Specialized casting occupations	47. 4
Materials movement, mechanical	3. 9
Equipment maintenance and repair	7. 4
Machining occupations	3. 0
Laborers and service occupations	23. 0

To explain more clearly the work in a foundry and the duties of individual foundry jobs, this report first describes briefly the work flow of the most common casting process—sand casting.

The first step in foundry work after the casting has been designed is for the *patternmaker* to make a wood or metal pattern in the shape of the final casting desired. *Sand mixers* prepare sand for use in molding and coremaking. *Hand molders* make the sand molds into which metal is poured. The molds are made by packing and ramming sand around the pattern. *Molders' helpers* may assist in these operations. *Machine molders* operate one of several types of machines which simplify and speed the making of large quantities of identical sand molds. *Coremakers* shape the bodies of sand, or "cores," which are placed inside molds in order to form any hollow spaces needed in castings. *Core assemblers* may be used to put together core sections. *Core-oven tenders* operate furnaces in which cores are often baked. With the mold made and the cores, if any, put inside, the next step is to pour the molten metal into the mold.

COURTESY OF U. S. NAVAL GUN FACTORY

Melter's helper pouring molten aluminum into molds.

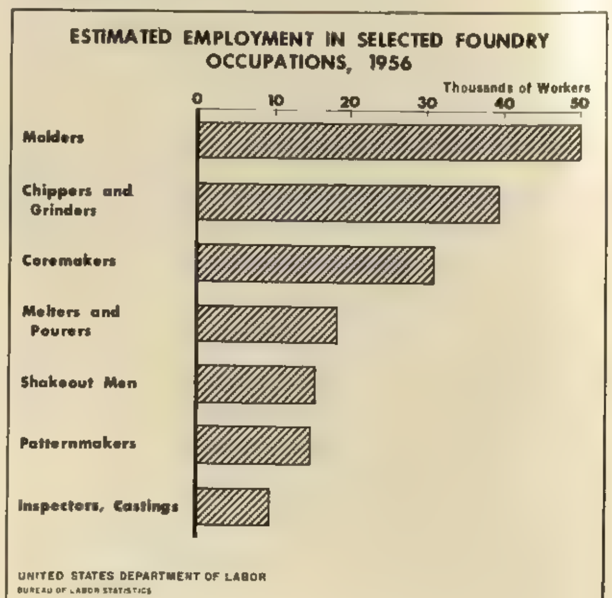
A *melter* operates a furnace used to melt metal for castings. The actual pouring is customarily done by a *pourer*, although in some small foundries it is part of the molder's job. When the casting has cooled off, it is taken out of the mold by *shakeout men*, and sent to the cleaning and finishing department. *Tumbler operators* and *sandblasters* smooth the rough surfaces of the castings by operating a machine that tumbles the castings in a revolving drum or by applying blasts of air mixed with abrasive particles. *Chippers* and *grinders* use pneumatic hammers and powered abrasive wheels to remove excess metal and finish castings. The casting may be placed in an annealing furnace to improve its physical properties; *annealers* run these furnaces. *Casting inspectors* then check finished castings for structural soundness and proper dimensions.

The estimated number of workers in the principal unique foundry occupations are shown in chart 43. Detailed discussions of the duties, training, and other qualifications; earnings; and employment outlook for three principal foundry occupations—molders, coremakers, and patternmakers—will be found at the end of this chapter.

There are many occupations which are not peculiar to foundry work, but which are nevertheless represented in foundries. Included among these are about 34,000 workers who maintain and repair foundry plant and equipment, such as maintenance mechanics, machinists, carpenters, and millwrights. Foundries employed an estimated 9,000 crane and derrick operators and 5,000 truckdrivers in mid-1956. In many foundries, some of the castings are machine finished. About 10,000 machine tool operators were employed in this work. Foundries also employed more than 100,000 workers in relatively unskilled jobs, such as guards, janitors, laborers, and helpers.

About 70,000 foundry workers were employed in professsional, office, managerial, or sales jobs. Included in this group were more than 7,000 engineers, chemists, metallurgists, and other scientists. Some of these technical personnel were employed in research activities. Engineers and other technical personnel have been employed in foundries in recent years to improve castings to meet new production requirements. Constant effort has been made, for example, to devise methods of reducing the weight of castings without losing strength and other important characteristics. Another facet of research deals with the problem of obtaining greater dimensional accuracy in the molding process. Other engineers and scientists are employed in the design and layout of machinery and equipment and in the supervision of plant operation and maintenance. About 2,000 technicians are used in a variety of functions having to do with quality control in casting produc-

CHART 43



tion. Included among them are workers with such specialized duties as the testing of molding and coremaking sand, chemical analysis of metal, operation of machines which test the strength and hardness of castings, and the use of X-ray or magnetic apparatus to inspect the internal structure of castings.

The customary employment practice is to hire only men for most foundry plant occupations. During World War II, a large number of women were employed in such plant jobs as coremaking, but the number declined at the war's end. In mid-1956, about 4 percent of all employees in independent ferrous foundries were women.

Negroes are a growing part of the foundry work force. In 1956, they accounted for about one-third of the plant workers in foundries. They are employed in skilled as well as unskilled jobs, with a considerable number working as skilled molders and coremakers.

Training and Other Qualifications

Most foundry plant workers start in unskilled jobs such as laborer or helper. Specialized jobs in the plant are frequently filled by upgrading. In this way, a worker in one level of work, such as a laborer, is given a chance to work on a higher skilled job. He is given informal on-the-job training and, assisted by a foreman or experienced worker, gradually learns the various aspects of the new work. This is the usual practice in training workers for such direct casting process jobs as melter, chipper, and grinder and frequently is used in the craft maintenance occupations. However, the majority of skilled foundry workers—particularly hand molders, hand coremakers, and patternmakers—learn their jobs through formal apprenticeship. In this type of training, the young worker is given supervised on-the-job training for a period of from 3 to 5 years, usually supplemented by classroom instruction. Workers who have completed an apprenticeship program are usually preferred by foundry management because of their greater versatility and their greater potential for supervisory jobs.

Employment Outlook

Foundry employment is expected to show only a small growth in the late 1950's and the 1960's. The foundry work force will increase at a slower rate than the Nation's total labor force. However, because this is a large field of work, replacement needs will provide thousands of job opportunities for new workers during this period.

Long range prospects are for a relatively large increase in foundry output. Many of the industries which use large quantities of castings in their products, such as the aircraft, automobile, construction, and machinery industries, are expected to expand their output considerably during the next two decades. Continued growth in the Nation's population and the trend toward a greater amount of metal being used per person will result in a substantial increase in metal consumption in the United States. The output of steel is expected to increase by at least a third in the 1956–66 decade and the output of lighter metals will undoubtedly increase at a faster rate. The casting method is expected to maintain its relative importance in metalworking activity. Thus, foundry production can be expected to show a substantial rise during the late 1950's and the 1960's.

Foundry employment, however, is expected to increase at a much lower rate than foundry production. The continued advances in technology, particularly greater mechanization of material handling and machine molding and coremaking, are resulting in greater output per worker. This trend in increased productivity is a continuation of recent experience. For example, from 1950 to 1955 production of iron and steel foundries increased 13 percent, whereas employment increased only 3 percent.

Some differences are expected in the rate of growth of individual occupations. The number of direct process workers, such as hand molders and hand coremakers will decrease as a proportion of total foundry employment, whereas employment of maintenance workers and operators of material movement machines will become more important. The proportion of laborers and other unskilled workers will decline. Technical personnel will continue to make up an increasingly larger percentage of foundry employment as scientific techniques in casting replace the old "rule of thumb" methods and quality and quantity control, and research activities increase. Despite the increasing use of lightweight metals, such as aluminum and magnesium, the rate of growth in foundry employment is expected to be about equal in ferrous and nonferrous foundries.

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Because foundry work is a relatively large field with more than 460,000 employees, the need to replace workers who die, retire, or transfer to other activities will provide many openings for new workers. Deaths and retirements alone should provide about 10,000 openings annually.

Foundries are important producers of war materials and, as a result, boom in mobilization periods. Employment in foundries nearly doubled from 1939 to the peak World War II year of 1943. Foundries are also sensitive to downturns in general business conditions. Business declines such as occurred in 1949 and 1954 resulted in significant drops in foundry employment.

Earnings and Working Conditions

Wages in foundries are somewhat above the average for manufacturing as a whole. In July 1956, production workers in independent iron and steel foundries earned an average of $85.26 a week and $2.10 an hour (including pay for overtime and nightwork). In independent nonferrous foundries, the average was $89.13 a week and $2.19 an hour. This compares with average weekly earnings of $79 and average hourly earnings of $1.97 for production workers in all manufacturing industries in the same month.

Working conditions in foundries vary widely. In some foundries, particularly the older unmechanized shops, safety and comfort are below average for factory work, generally. In many of the newer foundries, considerable success in improving working conditions has been achieved by reducing the heat, fumes, smoke, and noise that are part of foundry operations.

The injury rate in foundries tends to be relatively high compared with other manufacturing industries. But the injury-frequency rate, the average number of disabling work injuries for each million employee hours worked, has been going down steadily. For example, in the period from 1947 to 1956, independent gray-iron and malleable foundries reduced their rate from 41.2 to 27.8 and the rate in independent nonferrous foundries declined from 27.0 to 16.1. The average injury-frequency rate for all manufacturing industries was 11.9 in 1955.

The frequency of accidents varies among the different foundry occupations. In general, patternmaking and coremaking have the lowest injury rate, molding a somewhat higher rate, and jobs in melting and chipping tend to have the highest injury rates.

The large majority of foundry workers are union members. The principal labor organizations covering these workers include the International Molders and Foundry Workers Union of North America, the United Steelworkers of America, and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America. Nearly all of the patternmakers are members of the Pattern Makers' League of North America.

Where To Go for More Information

International Molders and Foundry Workers Union of North America,
1225 East McMillan St., Cincinnati 6, Ohio

Nonferrous Founders' Society,
192 N. Clark St., Chicago 1, Ill.

Gray Iron Founders' Society, Inc.,
National City–East Sixth Bldg., Cleveland, Ohio

American Foundrymen's Society,
Golf and Wolf Sts., Des Plaines, Ill.

Molders

(D. O. T. 4–81.010 and .030; 4–91.050; 6–81.010 and .020)

Nature of Work

Molders prepare sand molds into which metal is poured to make castings. A mold is made by packing and ramming prepared sand into a container called a flask around a pattern resembling the object to be duplicated, then removing the pattern and leaving in the sand a hollow space in the shape of the casting to be made. The sand is chemically prepared so that it will hold its shape and not crumble when molten metal is poured into the mold. The approximately 50,000 molders are classified into two groups, hand or machine molders. Hand molders use mainly hand methods in making the sand molds. Molds for small castings are usually made on the workbench by *bench molders;* those for large and bulky castings are made on the foundry floor by *floor molders.* Skill requirements in this occupation vary considerably. An all-round hand molder (journeyman)

COURTESY OF U. S. NAVAL GUN FACTORY

Hand molder ramming sand around a pattern in the flask.

makes many different kinds of molds. A less skilled molder does more repetitive work, specializing on a single kind of mold. Hand molders are employed mainly in jobbing foundries.

Machine molders operate one of several types of machines which simplify and speed the making of large quantities of identical sand molds for castings. The machine molder's duties consist mainly of assembling the flask (molding box) and pattern on the machine table, filling the flask with prepared sand, and operating the machine by the properly timed use of its control levers and pedals. Machine molders sometimes are qualified journeyman molders who require little supervision and who set up and adjust their own machines. More commonly, however, the machine molder is a semiskilled worker, whose duties are limited to operating the machine which is set up for him. Machine molders are employed mainly in production foundries which make large quantities of identical castings.

Qualifications and Training

Completion of a 4-year apprenticeship, or the equivalent in experience, is needed to become a journeyman molder and thus qualify for all-round hand molding and for the skilled specialized or supervisory jobs. Men with this training are also preferred for some kinds of machine molding.

The molder apprentice works under the close supervision of journeymen who instruct him in the skills of the craft. About half of the apprenticeship training is devoted directly to molding. Working closely with a journeyman molder, the apprentice may begin with simple tasks, such as shoveling sand, and gradually take on more difficult and responsible work, such as ramming molds, withdrawing patterns, and setting cores. He also learns to operate the various types of molding machines used in the foundry. As his training progresses, he makes complete molds, under supervision, beginning with simple shapes and going on to those of increasing complexity. This molding phase of his apprenticeship includes both floorwork and benchwork. In addition to learning molding, the apprentice works in other foundry departments in order to develop the diversified knowledge of foundry practice needed by fully qualified molders. He learns about sand preparation, melting of metal, and the cleaning and finishing of castings. The apprentice usually receives, in addition to his shopwork, at least 144 hours of classroom instruction each year in such subjects as shop arithmetic, metallurgy, and shop drawing.

It is also possible for a man to develop journeyman skill without apprenticeship training. Molders' helpers and less skilled hand molders sometimes succeed in acquiring informally the various elements of skilled molding, and then seek jobs as journeymen. However, this is a lengthier and less reliable way of learning the trade than through apprenticeship.

The less skilled type of hand molding, in which highly repetitive work is done, requires only a brief training period. "Learners" (either men without previous foundry experience or upgraded foundry helpers) are assigned to work with a molder engaged in making a particular kind of mold. After 2 to 6 months of this training, the learner is usually competent to make the same mold, or one that is roughly similar, on his own responsibility.

For machine-molding jobs of the more difficult and responsible types, a molding apprenticeship or equivalent training is required. However, machine molding of the less skilled variety, is ordi-

narily learned in 60 to 90 days of on-the-job training.

For a molding apprenticeship, an eighth grade education is usually the minimum requirement, and many employers specify additional schoolwork up to and including high school graduation. Eighth grade schooling, however, is sufficient for most jobs as learners of less skilled hand molding or machine molding.

Physical standards for molding jobs are fairly high because of the need for continual standing and moving about and frequent lifting. For hand molding, a high degree of manual dexterity and good vision are essential. Since the work is fairly strenuous, very few women are employed as molders.

Employment Outlook

Little increase in employment of molders is expected during the late 1950's and the 1960's. Replacement needs, however, will provide many opportunities for new workers to enter the trade.

The continuation in the trend toward more machine molding and less hand molding and increasing use of permanent molds and shell molds will result in a greater foundry output per molder employed. Thus, the expected large increase in foundry activity (see discussion, p. 353) will result in little growth in the number of molders.

The need to replace molders who die, retire, or transfer to other fields of work will provide many opportunities for new workers to enter molding. Deaths and retirements alone will provide about 1,000 openings annually during the 1956–66 decade. There will be several hundred opportunities each year for young men to obtain molding apprenticeships leading to journeymen molding jobs. There will be even more openings for workers for entry jobs in machine molding and in the less skilled types of hand molding.

Earnings and Working Conditions

Molders are among the better paid foundry workers. In mid-1956, molders were generally earning from $2.20 to $2.60 an hour depending upon locality and type of foundry.

Most molders are members of labor unions. Many of them have been organized by the International Molders and Foundry Workers Union of North America. Others are members of industrial unions such as the United Steelworkers of America, and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America.

Coremakers

(D. O. T. 4–82.010)

Nature of Work

Coremakers prepare the bodies of sand or "cores" which are placed in molds to form hollows or holes required in metal casting. Molten metal flows around the core so that when the core is later removed, the desired cavity is left. Cores are made both by hand and by machine. A core is made by packing prepared sand into a hollow form (core box) of the desired shape. Cores may then be baked to harden them.

In hand coremaking, small cores are made on the workbench by *bench coremakers* and bulky cores are made on the foundry floor by *floor coremakers*. There is a wide range of skill requirements in this occupation. All-round hand coremakers (journeymen) prepare a variety of larger or more intricate cores. The less skilled coremakers make the smaller and simpler cores frequently produced in large numbers, so that the work is highly repetitive. Journeymen hand coremakers usually work in jobbing foundries. Some journeymen coremakers work in production foundries as supervisors. The less skilled hand coremakers are generally employed in production foundries.

Machine coremakers operate several different types of machines which force sand into specially shaped hollow forms to make the sand cores. Some machine coremakers are required to set up and adjust their own machines and do any necessary finishing operations on the cores. Other coremakers are primarily machine tenders. They are more closely supervised and the necessary adjusting of the machines is done for them. Machine coremakers are employed mainly in production foundries where large quantities of identical castings are made.

COURTESY OF U. S. NAVAL GUN FACTORY

Coremaker setting reinforcing wires in sand in a core box. On the truck are finished cores ready to go to the baking oven for hardening.

Training and Other Qualifications

Completion of a 4-year apprenticeship or the equivalent in experience is needed to become a skilled hand coremaker. Coremaking apprenticeships are also sometimes required for the more difficult and responsible machine coremaking jobs. Coremaking and molding training are often combined in a single apprenticeship. The apprentice works with journeymen coremakers, first helping them in routine duties and then undertaking more advanced work under close supervision, such as making simple cores, or operating core ovens. As his skill increases, the apprentice makes more complex cores. He acquires experience in benchwork and floorwork and in the operation of any coremaking machines used in the plant. On-the-job training is generally supplemented by classroom instruction covering such subjects as arithmetic, shop drawing, and the properties of metals. For the less skilled hand coremaking and for most machine coremaking jobs, only a brief period of on-the-job training is needed. An eighth grade education is usually a minimum for coremaking apprentices, and some employers require that apprentices be high school graduates.

Persons without previous foundry experience may be hired directly into the less skilled coremaking jobs, or foundry laborers or helpers may be upgraded to do this work. Physical requirements for light coremaking are not particularly high because the work is not especially strenuous. A high degree of manual dexterity is necessary for much of the handwork. Women are frequently employed to do light coremaking.

Employment Outlook

The expected large increase in demand and output of foundry products (see discussion, p. 353) will result in only a moderate growth in the number of coremakers. The continued trend toward a greater proportion of cores being produced by machine rather than by hand and the resulting greater output per worker will limit the growth in the employment of coremakers.

Replacement needs, however, will provide many job opportunities for new workers to enter this occupation. The need to replace workers who die or retire will create about 500 job openings annually during the 1956–66 decade. Many other new workers will be needed to replace experienced coremakers who transfer to other fields of work.

Earnings and Working Conditions

Coremakers generally earn more than the average for foundry plant workers and for factory workers generally. In mid-1956, coremakers were generally earning from $2.20 to $2.60 an hour, depending upon locality. Hand coremakers with all-round training have opportunities for promotion to supervisory jobs.

Most coremakers are members of labor unions. Many of them have been organized by the International Molders and Foundry Workers Union of North America. Others are members of industrial unions, such as the United Steelworkers of America, and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America.

Patternmakers

(D. O. T. 5–17.010 and .020)

Nature of Work

Patternmakers are the highly skilled craftsmen who construct patterns and core boxes—the forms used to shape molds and cores. They are classified, primarily, according to the kind of material they use in making patterns. About half of the 15,000 patternmakers construct metal patterns. Of the remainder, most are wood patternmakers, although a few work with other materials, such as plaster.

A patternmaker works from blueprints and plans the pattern, taking into consideration the manner in which the object will be cast and the type of metal to be used. The wood patternmaker selects the appropriate woodstock and lays out the pattern, marking the design for each section on the proper piece of wood. Using power saws, he cuts each piece of wood roughly to size. He then shapes the rough pieces into their final form, using various woodworking machines—such as borers, lathes, planers, bandsaws, and sanders—as well as many small handtools. Finally, he assembles the pattern segments by hand.

The duties of a metal patternmaker are much the same as those of wood patternmakers except that he uses metal and metalworking machines instead of wood and woodworking equipment. Metal patternmakers prepare patterns from metal stock, or more commonly, from rough castings made from an original wood pattern. To shape and finish their work, they use a variety of metalworking machines, including the engine lathe, drill press, milling machine, power hacksaw, grinder, and shaper.

Throughout his work, the patternmaker carefully checks each dimension of the pattern. A high degree of accuracy is required, since any imperfection in the pattern will be reproduced in the castings made from it. Other duties of patternmakers include making core boxes (in much the same manner as patterns are constructed) and repairing patterns and core boxes.

Patternmaking is done in specially equipped pattern shops, which are of two types—independent and integrated. In mid-1956, employment of patternmakers was about equally divided between the two types of shops. Independent pattern shops are separate establishments which make pat-

COURTESY OF U. S. NAVAL GUN FACTORY

Patternmaker putting the finishing touches on a wood pattern.

terns on order for other firms. An integrated shop may be operated in conjunction with a foundry which uses the patterns, or it may be the pattern department of a plant that buys castings from a commercial foundry.

Training and Other Qualifications

Apprenticeship, or a similar program of on-the-job training, is the principal means of qualifying as a journeyman patternmaker. Because of the high degree of skill and the wide range of knowledge needed for patternmaking, it is very difficult to obtain the necessary training by informally picking up the trade. However, in some instances skilled machinists have been able to transfer to patternmaking with additional on-the-job training or experience. Good trade school courses in patternmaking provide useful preparation for the prospective apprentice, and may in some cases be credited toward completion of the apprentice period. However, these courses do not substitute for apprenticeship or other on-the-job training.

The usual apprenticeship period for patternmaking is 5 years, or about 10,000 working hours. At least 720 hours of classroom instruction in re-

lated technical subjects is normally provided. There are separate apprenticeships for wood and metal patternmaking.

The patternmaker apprentice begins by helping journeymen in routine duties. Then he makes simple patterns under close supervision, gradually learning to use the various types of machine and handtools. As his training progresses, the work becomes increasingly complex and the supervision more general.

Patternmaking, although not strenuous, requires considerable standing and moving about. A high degree of manual dexterity is especially important because of the precise nature of many hand operations. Employers generally require apprentices to have at least a high school education.

Employment Outlook

Little change in the number of patternmakers is expected in the late 1950's and the 1960's. Despite the increase in foundry production, the number of patternmakers has not grown significantly for several decades. Mass production, which has meant the preparation of large numbers of identical castings, is resulting in greater use of metal and plastic rather than wood patterns. The more durable metal patterns can be used many times in the making of identical molds and thus the number of individual patterns required for a given number of castings has declined. It is expected that this trend will continue at least during the 1956–66 decade.

However, replacement needs will provide job opportunities for new workers to be trained as patternmakers. It is estimated that about 500 new patternmakers will be needed annually during the 1956–66 decade to replace workers who die, retire, or transfer to other fields of work. Most of the job openings will be in metal patternmaking.

Because patternmakers learn either the basic metalworking or woodworking skills, they can find jobs in related fields when patternmaking employment is not available. Wood patternmakers can qualify for skilled woodworking jobs such as cabinetmakers, and metal patternmakers can transfer their skills to machine shop jobs such as machinists or layout men.

Earnings and Working Conditions

Patternmakers are one of the highest paid groups of skilled workers in manufacturing. In mid-1956, most patternmakers had straight time hourly earnings between $2.40 and $2.80. Some had hourly rates of more than $3.60. Nearly all patternmakers are members of a labor union—the Pattern Makers' League of North America.

FORGE SHOP OCCUPATIONS

Nature of Work

Forging is a basic metalworking process in which heated metal is shaped by hammering or squeezing under great pressure. Some forge shop workers prepare the metal for forging by heating it in a furnace. Others manipulate the heated metal under forging hammers and perform trimming, grinding, or other finishing operations on the forged pieces. (Machining, maintenance, custodial, or other workers employed in forge shops but not directly engaged in the forging process are not discussed in this chapter.)

The forging process is used to shape metal objects which must withstand great stress, such as, automobile crankshafts, gears, and marine engine drive shafts. The process is similar to that used by the oldtime blacksmith, except that machine power is substituted for the blacksmith's arm and dies replace his hammer and anvil. The basic equipment used by forge shop workers consists of various types of power hammers and presses. Forge shop workers also use many different types of handtools and measuring devices such as tongs, wrenches, swages, hammers, steel rules, and calipers.

The principal forgeshop jobs are those concerned with the operation of forging hammers and presses. Crews, generally consisting of from 2 to 10 men, operate the forging equipment used to pound or press metal parts into shape. Operators and their helpers on hammer and press crews customarily specialize on a particular kind of equipment. Duties of some of the more important forge shop workers are described below:

Hammersmiths (D. O. T. 4–86.120). These skilled workers operate power hammers equipped with unshaped (open) dies to hammer metal into desired shapes. The open die process is employed in forging objects which are too large for closed dies (shaped to form a particular object) or which are needed in quantities too small to justify the expense of making closed dies. The accuracy of forged parts made with flat die hammers depends upon the skill of the hammersmith. He manipulates the heated metal between strokes of the hammer so that the metal is formed to the desired shape before it cools. The hammersmiths may also use various forming tools such as swages under the hammer to produce angles and curves.

A hammersmith interprets blueprints, drawings, or sketches to determine the procedure of working the metal under the hammer. He directs a crew of assistants in the manipulation of the metal and controls the stroke of the hammer so that the piece being forged will be shaped exactly to specifications. He may supervise an assistant operator ("hammer driver" or "hammer runner"), a heater, a craneman, and one or more helpers assigned to a hammer.

Hammermen (or Drop Hammermen Operators) (D. O. T. 4–86.110). These workers are responsible for the operation of forging machines in which the heated metal is pounded into shape between accurately machined (closed) dies. This drop die forging or impact die forging method is

Hammer driver and helper forging a crankshaft.

used to manufacture large quantities of accurate and uniform forgings such as automobile steering parts and crankshafts.

A drop hammerman may also direct the work of the heater and supervise the helpers assigned to his hammer. The operator may either set the dies in the hammer or direct his crew in setting up the dies on the anvil and ram of a drop hammer. Special care is required in the positioning of the metal stock in the machine. The larger the hammer and the stock, and the more intricate the pattern of the forgings, the higher the skill requirements.

The two principal types of hammers used by these workers are steam and board or air hammers. The operators of steam hammers are generally considered more skilled than board or air hammer operators because they control the force of the forging blow, which is uniform on the board hammer.

Forging-Press Operators (D. O. T. 4–86.125). These workers direct the operation of forging presses which shape metal by squeezing it between either open (unshaped) or closed (shaped) dies. Open dies press forging, which generally requires considerably more skill than closed die work, is used where a relatively small number of large pieces are required. In open die press forging, the operator shapes the heated metal by manipulating it between two flat dies or dies with very simple shapes. The operator's skill, therefore, is similar to that of the hammersmith. On large presses, the worker in charge supervises a crew which may include an assistant forging press operator, who operates the press, a craneman and several helpers.

Closed die presses are used mainly where large quantities of relatively small forgings—either steel or nonferrous—are needed. The closed die press operator may supervise a small crew or may work alone.

Both open and closed die press operators must know how to control the heating of the metal, regulate the pressure of the machine, and position the work in the dies. Their duties may also include setting up the press.

Upsettermen (D. O. T. 4–86.125). Upsettermen operate forging machines which move horizontally while applying squeezing pressure to metal being shaped between closed-impression dies. A small crew consisting of a heater and helpers is often supervised by an upsetterman. Among the duties of the upsettermen are the control of the heating operation, the adjustment of the machine's pressure on the metal, the alinement of the dies and the positioning of the metal stock between the dies. Deep-socket wrenches, aircraft engine cylinders, bolts, and valves are some of the products made in large quantities on upset machines.

Heaters (D. O. T. 4–88.081). Heaters control the supply of fuel and air in furnaces to heat different metals to the most suitable temperatures for forging. After the metal has been brought up to the proper heat, the heater may transport it to the forging machines.

Inspectors (D. O. T. 4–86.162). Semifinished and finished forgings must be checked for size, shape, quality, and other specifications by inspectors. Some inspectors examine forged pieces for flaws and faulty workmanship while the forgings are still hot. Others inspect forgings after trimming to determine whether required standards are met. Inspectors may use micrometers, calipers, or other measuring devices to determine whether forged parts meet exact specifications. Testing for flaws may also be done with strength and hardness machines, electronic testing devices, and other testing equipment.

A considerable number of forge shop workers are employed in cleaning and finishing operations. For example, *trimmers* remove excess metals from hot or cold finished forge pieces with presses equipped with trimming dies. *Chippers* use pneumatic hammers to remove imperfections from stock. *Grinders* remove burrs from completed forgings with mechanically powered abrasive wheels. *Blasters* operate sandblasting or shot-blasting equipment to clean and smooth forgings. *Picklers* dip forgings in an acid solution to remove scale. *Heat treaters* alter the physical properties of forgings by heating and cooling metals under controlled conditions. They may produce specified degrees of hardness and strength by cooling the metal parts in the air or by quenching them in baths of water, oil, or brine.

Where Employed

In late 1956, about 65,000 forge shop workers were employed in many different metalworking industries. Independent steel forging plants, which

produce forgings for sale to other users, employ more than 50 percent of forge shop workers. Many workers are also employed in the forge departments of plants which use forged parts in their final product. For example, the manufacturers of automobiles, farm machinery, handtools, and structural and ornamental products have forge departments in their establishments. A number of workers are also employed in forge shops operated as departments of steel mills.

Employment of forge shop workers is concentrated primarily in the metalworking centers of the Midwest and Northeast. Forge shops are located near the steel producing centers which provide steel for forgings as well as near the metalworking plants which are the major users of forged products. Five States have almost 70 percent of all forge shop jobs—Ohio, Illinois, Wisconsin, Pennsylvania, and Michigan.

Training and Other Qualifications

Most forge shop workers learn their skills through on-the-job training and work experience. As they acquire experience and learn their skills they progress from the simple to the more difficult jobs. Advancement to the skilled job of hammersmith, for example, requires several years of on-the-job experience.

A few companies offer apprenticeship training for the more skilled forge shop jobs. Their programs generally last 4 years and include 8,000 hours of varied training. The apprenticeship programs include learning the tools of the trade in addition to studying related subject matter. For example, hammersmith apprentices learn to operate hammers, presses, and furnaces, and the use of handtools. They also learn about the properties of metals, how to read blueprints, and how to weld.

The basic entry job on hammer and press crews is that of helper. Employers usually require no more than an eighth-grade education for helpers and other workers in entry occupations. However, young men interested in preparing themselves for the more skilled forge shop jobs and for supervisory positions should continue their education and study such subjects as mathematics, drafting, shopwork, and metallurgy. After a worker has served as a helper in a hammer or press crew he may be upgraded to the job of heater or he may be given the opportunity to try out for one of the more skilled jobs such as hammerman or press operator.

Training requirements for inspectors vary. Those inspectors who visually inspect the rough forgings, using simple gages, can usually perform their jobs after a training period lasting only a few weeks. However, inspectors who examine forgings manufactured to exact specifications are required to have some technical background in metallurgy, blueprint reading, and mathematics and they may need several months of on-the-job training before they can operate the more complicated testing equipment.

Employment Outlook

The long-run prospects are for a moderate growth in forge shop jobs during the late 1950's and the 1960's. New jobs wil be created as a result of the anticipated expansion in the metalworking industries which use forged parts in their final products—particularly the aircraft, industrial machinery, and automobile industries.

Developments are now taking place which indicate a wider application of the forging method to produce metal parts. On the other hand, the use of castings to replace some forged parts in automobile manufacturing and the mechanization of the forging process may limit somewhat the growth of forge shop occupations. Mechanization may primarily affect the employment of helpers since the latest mechanical developments in the forging process are designed to reduce manual handling jobs before and after forging. Mechanization is expected to have little effect upon the need for skilled hammersmiths and forge-press operators because machines cannot be easily substituted for the skill and experience of these workers.

In addition to job openings resulting from increased activity in forge shop operations, job opportunities will arise from the need to replace those workers who leave the forge shops because of deaths, retirements, and transfers to other fields of work. Deaths and retirements alone should result in some 15,000 job openings in forge shop occupations during the 1956–66 decade.

Earnings and Working Conditions

Forge shop workers are among the highest paid factory workers. In September 1956, production workers (including unskilled and semiskilled

workers as well as skilled craftsmen) in independent iron and steel forging plants averaged $104.08 a week and $2.52 an hour. Production workers in all manufacturing industries averaged $81.40 a week and $2 an hour in the same month.

The prevalence of incentive pay and the relatively difficult working conditions are factors in the level of forge shop earnings. The highest paid forge shop workers are the skilled hammersmiths, drop hammer operators, and press operators. In mid-1956, they were generally receiving more than $3 an hour.

Most forge shop workers are union members. Many are members of the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers. Others have been organized by the United Steelworkers of America and the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America. Many of the plants which employ forge shop workers have labor-management contracts which provide insurance and pension plans.

Although forge shops are typically hot and noisy, and much of the work is strenuous, working conditions have been improved in recent years. Many firms have installed large fans and have attempted to reduce machine concussion and vibration.

Although the injury-frequency rate in forge shops is higher than in many other types of factory work—it has been declining in recent years because of the greater emphasis upon safety precautions. Forge shop firms and unions have promoted the greater use of protective goggles, metal-toe shoes, metal helmets, and safety guards at the machines which have contributed to the reduction of accidents in forge shops.

Where To Go for More Information

Drop Forging Association,
419 South Walnut St., Lansing 33, Mich.

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers,
8th at State Ave., Kansas City 11, Kans.

OTHER TRADES AND INDUSTRIAL OCCUPATIONS

Blacksmiths

(D. O. T. 4–86.010)

Nature of Work

Blacksmiths make and repair tools, industrial and agricultural equipment, and other metal articles and parts by heating the metal in a forge and hammering it on an anvil into the desired shape. They also forge-weld metal by heating and joining pieces. Blacksmiths sharpen chisels, drills, picks, and other tools by reshaping the cutting edges.

In making new articles or parts, the blacksmith may first study drawings and other specifications which show the desired design of the article and the type of metal to be used. He heats the metal stock in a forge and determines by observing its color, when it is ready for hammering. He removes the metal part from the forge and hammers it into shape by hand or machine. After forming the piece, the blacksmith may heat-treat the metal to bring it to the proper hardness and temper. He does this by heating it and then immersing it in an oil or water bath.

Blacksmiths use hand hammers, tongs, chisels, and vises in their work. In addition to these handtools, they often use welding equipment, grinders, presses, and automatic hammers.

COURTESY OF NATIONAL ARCHIVES

Blacksmiths use mainly hand methods to shape and repair metal pieces.

Where Employed

Blacksmiths are employed in many different types of establishments—in one-man repair shops as well as in some of the country's largest factories. In 1956, 40 percent of the Nation's 40,000 blacksmiths worked in small shops repairing farm and garden equipment, tools, automobile parts, and household articles. Often these shops perform other services such as welding and tool dressing; a few shoe horses. Many blacksmiths operate their own repair shops.

About one-quarter of all blacksmiths are employed in maintenance and repair departments in the railroad, construction, coal-mining, steel, and machinery manufacturing industries. Other blacksmiths work at production jobs in metalworking establishments where they operate automatic machines to make large numbers of identical articles. The petroleum industry employs between 3,000 and 4,000 blacksmiths or tooldressers. Most of these workers sharpen and temper drilling bits and tools and assist the driller in operating and maintaining the drilling equipment.

Blacksmiths work in all parts of the country, in small rural communities as well as in large industrial centers. There is some concentration of employment in Pennsylvania, Texas, and Illinois.

Training and Other Qualifications

Most workers enter the occupation by picking up the trade while working as helpers in blacksmith shops. Workers who learn this trade in the railroad industry usually enter through apprenticeship training. The apprenticeship period is generally 3 or 4 years and customarily includes training in blueprint reading, the use of tools and equipment, heat-treatment of metal, forging methods, and welding. High school and vocational school courses in metalworking, blueprint reading, and mathematics will prove helpful to young persons interested in becoming blacksmiths.

A blacksmith must have considerable strength in order to pound metal into shape and to handle heavy parts. He must also have a precise touch in the shaping of metal parts even though he uses heavy tools and equipment.

Employment Outlook

There will be a small number of job opportunities each year for new workers to enter the field during the late 1950's and the 1960's. Openings for new workers will occur primarily because of replacement needs. A high proportion of the experienced blacksmiths are older men who will be leaving the labor force. Deaths and retirements will result in about 1,500 openings a year for new workers during the late 1950's and the 1960's.

Prospects for those entering the occupation are for continued employment over a long period. About 40,000 blacksmiths were employed in late 1956, substantially fewer than 20 or 30 years earlier. However, there has been little decrease in employment in recent years and no substantial change in the demand for blacksmiths is anticipated in the next decade. The number of blacksmiths working in small repair shops is expected to remain stable because of the diversified demands for their services and the importance of blacksmith repair shops in local communities. Since blacksmiths employed in manufacturing plants, railroads, construction, and mines generally do maintenance work, which tends to be fairly steady, there should not be much fluctuation in the number of jobs for blacksmiths in these activities.

Earnings and Working Conditions

The earnings of skilled blacksmiths depend upon the part of the country where they are employed and the kind of shop or industry in which they work. In 1956, the average straight-time hourly earnings for smiths employed in railroad shops was $2.19. The union rate for experienced blacksmiths in the steel industry was $2.64 an hour in that same period. Although no overall wage data are available for blacksmiths employed in the petroleum industry, an examination of a few 1956 union contracts indicates that blacksmiths (tooldressers) were earning journeymen union rates of $3 an hour in some petroleum refineries. Tooldressers, working as part of drilling teams in the oilfields, were receiving union wage rates of $2.50 an hour. Wage data collected from a limited number of employers indicated that blacksmiths in small repair shops on the East Coast were receiving between $1.75 and $2.30 an hour in 1956.

A young man learning the trade will usually start at 50 to 70 percent of the skilled worker's rate and receive periodic increases. By the end of his training period, he will receive the full journeyman rate.

Although all blacksmith shops are rather hot and noisy because of the furnaces and hammers, there is some variation in the conditions under which blacksmiths work. In small repair shops, the noise is not constant and the temperature is more easily controlled. The large forges and the sound of many automatic hammers in large production shops create considerable heat and noise. In recent years, however, the introduction of large ventilating fans and the reduction of machine vibration have improved working conditions in production shops.

Blacksmiths are subject to a number of hazards. These include burns from forges and heated metals, and cuts from flying metal chips. Safety devices such as goggles and leather aprons have reduced hazards in this trade.

Many blacksmiths belong to unions. The principal union of the trade is the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers. Other blacksmiths are members of industrial unions such as the Oil, Chemical and Atomic Workers International Union and the United Steelworkers of America. Many union agreements provide health insurance and pension plans for blacksmiths.

Where To Go for More Information

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, 8th at State Ave., Kansas City 11, Kans.

Boilermaking Occupations

Nature of Work

Boilermakers, layout men, and fitup men specialize in the repairing, fabricating, and assembling of boilers, tanks, vats, and similar vessels made of metal plate. These boilers and other vessels are widely used throughout industry to hold liquids and gases under pressure. Boilermakers are primarily engaged in the repairing and erecting of boilers, while layout men and fitup men are usually employed in the manufacturing of new boilers and heavy tanks. The repair work performed by boilermakers requires these workers to be all-round skilled craftsmen; fitup men and layout men have more specialized duties.

Boilermakers (D. O. T. 4–83.100). These craftsmen assemble and erect prefabricated parts and fittings at construction sites where the boilers or vessels are to be used. After the installation is completed they make all the necessary tests to check for defects. Boilermakers doing repair work in the field first determine the cause of trouble. They may then dismantle the boilers, vessels, or other units, and make repairs such as patching weak spots with metal stock, replacing defective sections with new parts, or strengthening joints. The repair and installation work performed by boilermakers must often meet standards set by local building codes.

Boilermakers use a variety of tools and equipment in repair and assembly work. They cut and shape plate to size with power shears, power rolls, power presses, or oxyacetylene torches. They use welding or riveting equipment when repairing or assembling boilers. When assembling and erecting steel plate units in the field on a construction site, the boilermakers may use all types of rigging equipment including hoists, jacks, and rollers.

Boilermakers assembling units made of heavy steel plate.

Layout Men (D. O. T. 4–83.200). In the manufacture of units made of heavy steel plate or other metals, the metal is initially prepared for fabricating operations by layout men. They mark on the

plates and tubes all curves, lines, points, and dimensions which serve as directions to other workers for the cutting or shaping of the parts of boilers, tanks, and pressure vessels. They lay out the parts to scale as outlined on blueprints, sketches, or patterns. Layout men use compasses, dividers, scales, surface gages, hammers, and scribers in laying out the parts to be fabricated.

Fitup Men (D. O. T. 83.300). Before the various parts of boilers, tanks, vats, or other vessels are finally assembled, the fitup men assemble and temporarily fit them together in the shop. They bolt or tack weld parts together and correct irregularities in parts so that they fit together neatly and securely. Fitup men also assemble and fit together nozzles, pipes, fittings, and other parts.

Fitup men read and interpret blueprints and drawings used in the manufacturing process in order to check parts for accuracy and fit according to specifications. They use handtools such as hammers, sledges, wrenches, and punches, and equipment such as welding machines, portable drills, and grinding tools.

Where Employed

Boilermakers are principally employed in repair shops which specialize in servicing and repairing boilers and pressure vessels used in commercial and industrial companies; they also are employed in the railroad transportation and construction industries. The boilermakers employed by the railroads work, for the most part, in locomotive shops where they maintain and repair locomotive and stationary boilers, fireboxes, tanks, and other parts made of sheet iron or plate steel. Many boilermakers also work in the maintenance departments of industrial establishments to maintain and repair boilers, tanks, and other vessels. More than 2,000 boilermakers were employed in mid-1956, in Federal Government installations, principally in Navy shipyards, Federal powerplants, and wind tunnel test facilities.

Boilermakers are employed in every State because of the widespread need for their skills in maintenance and repair work. However, most of the boilermaking jobs are in the East North Central and Mid-Atlantic States where the metalworking industries and railroad shops are concentrated. Pennsylvania, Ohio, Illinois, and New York have the largest numbers of boilermaking jobs. In the West, California and Texas lead in the employment of boilermakers.

Layout men and fitup men are primarily employed in the boilershop products industry which produces fire-tube boilers, heat exchangers, heavy tanks, heating boilers, water-tube boilers, and similar boiler-type items. Most layout men and fitup men are employed in the industrial Middle Atlantic and East North Central areas where the boilershop products industry is concentrated.

Training and Other Qualifications

Although many men have become boilermakers by picking up the trade by working as helpers for several years, most training authorities agree that a 4-year apprenticeship is the best way to learn this trade. In the apprenticeship program, the apprentice works under the close supervision of a journeyman who instructs him in the skills of the trade. The apprentice learns how to use the tools and machines of the trade during his training period. Apprenticeship programs usually provide for about 8,000 hours of relatively continuous employment and training supplemented by at least 576 hours of related technical instruction. Some of the related technical subjects studied by apprentice boilermakers during their training period are: blueprint reading, trade mathematics, welding techniques, and trade metallurgical science covering stress and strain of metals.

Many layout men and fitup men learn their skills on the job. They are usually first hired as helpers and pick up the trade by working with experienced workers. It generally takes at least 2 years to qualify as a journeyman layout or fitup man in a fabricating shop where boilers and vessels are produced on a mass-production basis. However, in the railroad industry and in shops where products are custom made, layout and fitup jobs are generally filled by men who have first qualified as skilled boilermakers.

Prior training in mathematics, blueprint reading, and shopwork will prove helpful to young men interested in entering these trades. Mechanical aptitude and manual dexterity are important qualifications for persons who want to become boilermakers, layout men, or fitup men. They are also required to be in good physical health and able to do heavy work.

Employment Outlook

During the late 1950's and the 1960's, a moderate rise in the employment of boilermakers, layout men and fitup men can be expected. Most opportunities for new workers, however, will result from replacement needs.

The expected large expansion in electric power generation facilities and the development of atomic energy for industrial use will result in an increased need for these workers in boiler manufacturing plants and in the construction industry for the fabrication and assembly of industrial power boilers, smokestacks, heavy tanks, and other large vessels. Some additional maintenance boilermaking jobs will be created by the expansion of facilities in petroleum refineries, chemical plants, electric light and power plants, and steel plants.

In contrast to this growth, the employment of boilermakers in railroad repair shops is expected to decline. The number of these workers has been declining steadily since World War II because diesel engines have been replacing steam locomotives. In 1950, railroads employed 9,800 boilermakers, but by 1956, the employment of boilermakers in this industry had dropped to about 4,100.

Replacement needs will be the primary factor in creating job opportunities for new workers in these trades. Because a high proportion of experienced boilermakers, fitup men, and layout men are older men, many will be leaving the labor force during the next 10 to 20 years. Deaths and retirements alone may create about 8,000 new jobs during the 1956–66 decade. Additional job openings will be created by the transfer of experienced workers in these occupations to other fields of work.

Earnings and Working Conditions

The earnings of skilled boilermakers compare favorably with those of other skilled craftsmen. For example, the union wage rate of maintenance boilermakers in the basic steel industry was $2.74 an hour in July 1957. The average staight-time hourly earnings of boilermakers employed by Class I railroads were $2.32 an hour in March 1957. Recent earnings data of fitup men and layout men are not available.

A Bureau of Labor Statistics study of the minimum wage scales of union journeymen boilermakers in the building trades in 52 cities in 1956 showed a range from $3.10 an hour in Dallas, Tex., to $3.90 an hour in Newark, N. J. The average minimum hourly scale for union boilermakers in this study was $3.34. Boilermakers employed in the building trades are not as steadily employed throughout the year as those who work in maintenance departments of large industrial establishments.

Many boilermakers, layout men, and fitup men are employed in metalworking plants which have labor-management contracts. Some of these agreements provide health, insurance, and pension plans.

When engaged in boiler repair and assembly work, boilermakers are often required to work in cramped quarters and in high places. Some work must also be done under conditions of dampness, heat, and poor ventilation.

Boilermaking tends to be more hazardous than many other metalworking occupations. Although the injury-frequency rate in the boilershop products industry is considerably higher than the average for manufacturing industries as a whole, it has been declining in recent years because of the safety programs of employers and unions.

Most boilermakers, layout men, and fitup men belong to unions. The principal union of these trades is the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers. Some of these craftsmen are also members of industrial unions, such as the Industrial Union of Marine and Shipbuilding Workers of America, the Oil, Chemical and Atomic Workers International Union, and the United Steelworkers of America.

Where To Go for More Information

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers, 8th at State Ave., Kansas City 11, Kans.

Dispensing Opticians and Optical Mechanics

(D. O. T. 5–08.010)

Nature of Work

Dispensing opticians and optical mechanics (both frequently referred to as optical technicians) fill eyeglass prescriptions written by physicians and optometrists. Dispensing opticians help in the fitting of eyeglasses. Optical mechanics shape the lenses, and then insert them in frames or rimless mountings. Although the same person may do the work of both the dispensing optician and the optical mechanic, for the most part, these are two separate occupations.

Dispensing opticians work in retail optician establishments where they directly serve customers who are to be fitted for eyeglasses. One of their duties is to measure the patient's facial contours to determine the size and shape of the lenses most suitable. They also assist the patient in selecting the style and color of the frame.

The dispensing optician prepares a work order based on the prescription of the physician or optometrist so that the lenses may be properly ground and mounted by the workers in the laboratory or shop. After the finished eyeglasses are returned from the laboratory, the optician may make adjustments so that they properly fit the wearer. Dispensing opticians use small handtools such as optical pliers, hammers, pupilary distance rulers, and screwdrivers.

Optical mechanics perform the shop or laboratory work required to make up eyeglasses as prescribed by physicians or optometrists. There are two principal types of mechanics, the surface man and the benchman (or finisher). The surface man starts with standard or stock size lens blanks and carries out a series of operations which include the layout of the work, grinding and polishing the surfaces of the lenses, and final inspection. In small shops, one mechanic may perform all these operations. In large shops, the work is divided into separate operations so that semiskilled workers may perform part of the job. Surface men operate large power grinding and polishing machines when preparing lenses. They also use special equipment such as a lensmeter to measure lens curvature by light and a lens measure which mechanically measures the curvature and power of a lens.

The other principal type of optical mechanic—the benchman or finisher—marks and cuts the

Surfacers at a battery of generator machines. The man in the foreground is checking a partly ground lens using optical calipers to measure its thickness.

ground lenses to fit the frame. He then bevels or smooths the edges of the lenses and assembles the lenses and frame parts into the finished eyeglasses. In large laboratories, these operations are divided into job specialties so that semiskilled workers can perform single operations. The benchman uses small tools in his work such as lens cutters, chippers, pliers, and diamond point glass drills. Both the surface man and the benchman also do repair work. They may match broken lenses and replace damaged parts of the frame.

Where Employed

About 16,000 dispensing opticians and optical mechanics were employed throughout the country in mid-1956. Of these, about 7,500 (2,500 dispensing opticians and 5,000 optical mechanics, mostly benchmen) were employed in the Nation's 3,000 retail optician shops, which directly serve individuals by making their eyeglasses from prescriptions of physicians or optometrists. The remaining 8,500 workers (mostly surface men) were employed in the prescription departments of the more than 1,100 wholesale and manufacturing establishments which did work for retail optician firms. In addition to the 16,000 technicians mentioned above, many of the approximately 2,500 proprietors of retail optical establishments were skilled optical mechanics or dispensing opticians. Dispensing opticians and optical mechanics are primarily employed in large cities and industrial

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areas. New York, Pennsylvania, Ohio, California, and Illinois are the leading States in the employment of these workers.

Training and Other Qualifications

Most dispensing opticians and optical mechanics pick up their skills through informal, on-the-job training. They start in entry jobs such as grinding or polishing operators. By working with experienced mechanics for a few years, they learn the skills of the trade.

In addition to this informal method, young persons who are high school graduates and are not over 28 years of age can prepare for these occupations through formal apprenticeship programs. Most training authorities agree that workers who have learned their trade as apprentices have more opportunities and improved job security, and are able to advance further. The optical mechanic's apprenticeship program generally lasts 4 years, and the dispensing optician's training program covers 4 or 5 years.

The typical 4-year program for apprentice optical mechanics includes on-the-job training and related instruction in ophthalmic optics (vision improvement). The apprentices specializing in surfacing follow a work schedule which includes 2 years of training in grinding operations, 1 year in polishing, and 1 year in blocking, inspection, and layout. The benchmen apprentices follow a work schedule which includes 1 year in lens edging, 1 year in cutting layout and lens cutting, 1 year in lens drilling and rimless spectacle assembly, 6 months in frame inserting, and 6 months in inspection. In addition to this work experience, the apprentice optical mechanic receives related instruction which includes the identification of types of lenses, the measurement and curvature of lens surfaces, lens power, light prism power, prescription writing, and frame and eyeglass mounting.

The dispensing optician apprentice is given training similar to that of the bench apprentice. He receives additional instruction in optical mathematics, the relationship of the lens to the eye, the mechanics of dispensing, and inspection and evaluation of eyeglasses.

Formal school training plays a relatively small part in preparing for these occupations. However, academic training for entry into the dispensing optician occupation is being encouraged by organizations in the field. In 1956, at least 2 schools were offering a 2-year course at the college level in dispensing opticianry and a few vocational schools had courses for the training of optical mechanics.

Some States require dispensing opticians and optical mechanics to be licensed. Two States—Connecticut and New Jersey—license optical mechanics. Eleven States—Arizona, Connecticut, Georgia, Florida, Kentucky, Nevada, New Jersey, New York, North Carolina, Tennessee, and Virginia—require dispensing opticians to be licensed.

Advancement possibilities are available to both optical mechanics and dispensing opticians. Shop technicians can become supervisors or foremen in laboratories or shops. Many benchmen have become dispensing opticians, although there has been a trend in recent years to train directly for this latter job. There are opportunities for mechanics and dispensing opticians to go into business for themselves. In the 6 years from 1948 to 1954, the number of proprietors of optician establishments almost doubled—from 1,450 to about 2,450. These proprietors came, for the most part, from the ranks of mechanics and dispensing opticians.

Employment Outlook

A relatively large increase in these two occupations is expected in the late 1950's and the 1960's. This will be a continuation of the trend of the last 15 years during which time the number of optical technicians grew at a somewhat faster rate than the Nation's total labor force. Replacement needs will also provide a few hundred job opportunities each year for new workers.

More optical mechanics and dispensing opticians will be needed to perform the expected growing amount of prescription lens work. Our country's expanding population and the growing number of older persons—the group most likely to need eyeglasses—are among the factors which will cause an increase in the output of prescription lenses above the 1956 level of approximately 20 million pairs. More glasses will also be needed because good vision is becoming more essential to the type of work being performed in industry and in offices. Furthermore, eyeglass frames are now subject to style changes resulting in more frequent changes in prescription lenses. The increasing de-

mand for eyeglasses should result in a continued growth in the number of optical technicians, since no significant technological changes in this field are anticipated during the 1956–66 decade.

Although few women are employed as dispensing opticians or optical mechanics, they are being encouraged to enter the field. Some of the more specialized jobs found in the larger laboratories can be performed by physically handicapped persons who have full use of their eyes and hands and can do sedentary work.

Earnings and Working Conditions

Weekly earnings for qualified mechanics generally ranged from about $75 to $100 per week in mid-1956. Dispensing opticians usually earn about 20 percent more than optical mechanics. Apprentices start at about 50 percent of the skilled worker's rate. In the course of their training, their wages are increased periodically, so that at the end of the apprenticeship period they are receiving the pay of skilled technicians. Wholesale establishments usually have a 5-day, 40-hour workweek. Retail shop employees generally work a 5½- or 6-day week. Workers in these occupations usually have year-round employment.

The work of the dispensing optician requires little exertion and is generally performed in pleasant surroundings. On the other hand, most laboratories are fairly noisy because power grinding and polishing machines are used in preparing prescription lenses. The use of emery for grinding and rouge (powder) for polishing cause the hands of the mechanics to become stained.

Where To Go for More Information

Guild of Prescription Opticians of America,
110 East 23d St., New York 10, N. Y.

Association of Independent Optical Wholesalers,
222 West Adams St., Chicago 6, Ill.

Electroplaters

(D. O. T. 4–74.010)

Nature of Work

Platers work in electroplating shops where metal objects are coated with thin layers of metal such as cadmium, nickel, silver, gold, chromium, tin, or zinc in order to improve the objects' appearance and resistance to wear and corrosion. The electroplater cleans metal objects before plating, prepares the plating solution, immerses the objects in the chemical solution, and finishes them after plating. The actual plating takes place in the chemical solution when an electric current carries the metal coating particles to the object being plated. Such widely different items as automobile bumpers, cigarette lighters, silverware, costume jewelry, plumbing fixtures, electrical appliances, bearings, component parts of electronic equipment, jet engine parts, and ammunition are examples of metal products which are often electroplated.

COURTESY OF NATIONAL ARCHIVES

Electroplater removing racked articles from plating bath.

The skilled plater first studies specifications which indicate the parts of the objects to be plated, the type of plating metal to be applied, and the desired thickness. He prepares the plating solution by mixing the proper chemicals. The plater also determines the amount of electric current required to carry the metal particles through

the plating solution and the length of time the objects must remain in the solution so that the plating metal will be of the specified thickness. A plater must often use originality in designing special racks for holding the objects while they are in the plating tank. Plastic tape, lacquer, and other masking materials are used to block off parts of the objects not to be plated.

After these preparatory steps, the plater cleans the object by means of chemical baths and water rinses. He then places it in the plating tank, where an electric current carries particles of metal through the solution from the anode (the metal to be deposited) to the surface being plated. When the desired thickness has been obtained, he removes, rinses, and dries the object.

The plater must analyze the plating solution periodically and sometimes add chemicals to keep the solution constant. It is also necessary for him to control the temperature of the solution. He examines finished articles for defective plating and may use precise measuring instruments to check the thickness of the plating. In addition to plating, platers do other kinds of finishing, such as spray painting, dipping, and flow painting.

Electroplaters employed in job shops, which do small lot plating of great variety, are often required to use considerable ingenuity in their work. Platers working in production shops, where large lots of metal parts of the same type are electroplated, usually carry out routine assignments. In some of the larger shops, chemists and chemical engineers often make the technical plating decisions while platers act as foremen and do some of the routine plating work.

As a foreman, a plater often supervises the work of helpers, who place objects on racks before plating, remove them after plating, and clean tanks and racks. In some shops, a plater is expected to order chemicals and other supplies for his work.

Where Employed

Although electroplating shops are found in almost every part of the country, most are concentrated in the Northeast and Midwest near the centers of the metalworking industry. Over 25 percent of the approximately 20,000 platers employed in late 1956 were working in Chicago, Detroit, New York, Cleveland, Newark–Jersey City, Providence, and Buffalo.

About 8,000 electroplaters are employed in job shops specializing in metal plating and polishing. The remaining platers are employed in the plating departments of plants primarily engaged in the manufacture of plumbing fixtures, heating and cooking utensils, lighting fixtures, wire products, electric control apparatus, electric appliances, radio and television products, motor vehicles and parts, mechanical measuring instruments, miscellaneous hardware items, and other metal products.

Training and Other Qualifications

Most platers are first hired as helpers and then learn the trade by working with skilled platers. Learning the trade in this manner does not always provide the well-rounded preparation which would enable a young man easily to transfer his skills to shops doing other types of electroplating work.

Another way to enter the electroplating trade is through an apprenticeship program. Although apprentice training provides better all-round preparation, only a small percentage of electroplaters have been trained this way.

The planned program for apprentices includes a combination of on-the-job training and related classroom instruction in the properties of metals, chemistry, and electricity, as applied to plating. The apprentice does progressively more difficult work as his skill and knowledge increase. By the third or fourth year, he determines cleaning methods, does plating without supervision, makes solutions, examines plating results, and supervises helpers. After 3 or 4 years of an apprenticeship program or general work experience, the worker usually becomes a fully qualified plater. From this position he may qualify as a foreman.

High school and vocational school courses in chemistry, electricity, physics, mathematics, and blueprint reading will prove helpful to young persons interested in becoming electroplaters. Some colleges, technical institutes, and vocational high schools offer 1- to 2-year courses in the principles and practice of electroplating. In addition to the training offered by these schools, many branches of the American Electroplaters Society conduct basic courses in the fundamentals of electroplating. The increasing complexity of the plating process and the greater use of precision plating will require platers with a higher degree of technical training in the future.

Employment Outlook

The expected expansion in the machinery and metalworking industries in the late 1950's and the 1960's should increase the need for electroplaters. Broader application of the plating process brought about by recent developments in the use of aluminum, other metals, and metal alloys will increase the demand for skilled electroplaters. There appears to be no marked trend toward substituting other finishing methods for plating.

In addition to the new job openings which are expected to develop because of the increased use of the electroplating process, a small number of vacancies will develop from the need to replace those workers who die, retire, or shift to other lines of work.

A factor which might limit the growth of this occupation is the tendency of some of the large highly mechanized plants to employ chemists and chemical engineers to plan the plating operations, and to use skilled platers only as foremen. Mechanization of the plating process is not expected, however, to affect materially employment opportunities for platers.

Earnings and Working Conditions

Little information is available on the earnings of skilled electroplaters. However, an examination of a number of union contracts and information secured from a limited number of employees indicate that electroplaters were earning from $1.75 to $2.50 an hour in late 1956. During a worker's period of apprenticeship or on-the-job training, his wage rate usually starts at 60 to 70 percent of a skilled worker's rate, and progresses to the full rate by the end of his training period. In almost all plants, workers are paid shift premiums for working at night.

Plating work involves some hazards because acid, alkaline, or poisonous solutions are used. Problems of humidity and odor also prevail in electroplating plants. However, most plants have installed systems of ventilation and other safety devices which have considerably reduced the occupational hazards. Protective clothing and boots provide additional protection.

Many platers are union members. Most union platers belong to the Metal Polishers, Buffers, Platers and Helpers International Union. Other platers have been organized by the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America and the International Association of Machinists. Many of the labor-management contracts covering electroplaters provide health, insurance, and pension plans.

Where To Go for More Information

For more information on job opportunities, training, and other questions write to:

The American Electroplaters' Society,
445 Broad St., Newark 2, N. J.

National Association of Metal Finishers,
35 East Wacker Dr., Chicago 1, Ill.

Instrument Makers

(D. O. T. 4–75.130; 5–08.066)

Nature of Work

Instrument makers are highly skilled mechanics who have become increasingly important with the rapid growth of science and industry. These workers build scientific and industrial instruments by making parts and assembling them into finished products. The principal types of instruments used in American industry are mechanical, electronic, electrical, and optical. Many mechanical instruments are used to measure or regulate the pressure, flow, and temperature of gases and liquids; others regulate industrial processes. Some instruments are used to indicate airspeed or altitude. Gyroscopic devices aid in stabilizing aircraft and ships. Electronic instruments perform a variety of industrial functions, such as control of production operations and inspection of finished products. Electrical instruments measure the voltage, amperage, and other characteristics of electricity. Microscopes, bombsights, optical comparators, and refractometers are types of optical instruments.

The instrument makers discussed in this occupational statement include those who specialize in the construction of all types of mechanical and optical instruments. They exclude those who make electrical and electronic instruments.

COURTESY OF U. S. NAVAL GUN FACTORY

An instrument maker uses hand tools, in addition to machine tools, in making precision instruments.

Instrument makers carry through the entire operation of fabricating and assembling the complete instrument. In making the mechanical instrument, these skilled craftsmen determine the correct sequence of machining operations after receiving sketches, blueprints, or oral instructions. They use lathes, shapers, drills, and other precision equipment to produce metal parts of exact dimensions. Instrument makers are often required to devise temporary tools or devices to perform bench or machine operations where standard tools are not available. They use measuring instruments, such as micrometers and gages, to check the accuracy of their machining work. After the component parts are made, instrument makers assemble and fit them into a completed unit. They then use many types of testing equipment to check the construction and operation of the finished instrument.

Instrument makers specializing in making optical, aeronautical, or gyroscopic instruments have duties which differ somewhat from those of the mechanical instrument makers described above. For example, optical instrument makers specialize in the assembly and mounting of optical parts—such as precision lenses, prisms, and mirrors—in the mechanical sections of optical instruments. They scrape, file, and handlap metal mounts and accurately adjust the optical elements so that the calibrations on the instrument will read correctly.

Instrument makers generally are not engaged in the large-scale production of instruments. This work is subdivided and performed by less skilled workers, such as machine tool operators and assemblers. Many instrument makers construct experimental or pilot models of instruments which may eventually be produced in large quantities. These craftsmen, who are often called instrument modelmakers, work closely with scientists and engineers. Frequently, they contribute to the practical design and development of experimental equipment. They make instruments from rough sketches or oral or written instructions provided by scientists or engineers. Other instrument makers turn out special purpose instruments. Some instrument makers are employed in the production of small lots of relatively standard instruments.

The duties and skills of instrument makers are similar in many respects to those of machinists, tool and die makers, and skilled machine tool operators who also make metal parts with machine tools. The distinguishing feature of the instrument makers' jobs, setting them apart from these other metal craftsmen, is that instrument makers must be able to construct instruments from start to finish—making the metal parts, assembling them into complete instruments, and testing the finished instrument to see that it performs the operation for which it was intended.

Where Employed

The majority of instrument makers are employed by firms manufacturing laboratory, scientific, engineering, and mechanical measuring and controlling instruments. In addition, many instrument makers work for companies which make optical instruments and photographic apparatus. The Federal Government is a large employer of instrument makers. In mid-1956, about 1,500 instrument makers were working for the Navy, Army, Air Force, Bureau of Standards, Coast and Geodetic Survey, and other agencies doing technical work. University and commercial research laboratories employ instrument makers to make the special devices required in scientific research.

The main centers of instrument making are located in and around a few large cities, particularly Rochester, N. Y., New York City, Chicago, Minneapolis–St. Paul, Los Angeles, Boston, Philadelphia, and Washington, D. C.

Training and Other Qualifications

Most instrument makers are drawn from the ranks of machinists or skilled machine-tool operators. These craftsmen, working at first under close supervision and doing the simpler jobs in the instrument shop, usually need at least 1 or 2 additional years of experience to qualify as instrument makers.

Other instrument makers learn their trade through instrument-maker apprenticeships which generally last 4 or 5 years. The apprenticeship programs include not only shop training in the use of machine tools, handtools, and measuring instruments, but also study in related technical subjects, such as mathematics, physics, and blueprint reading. Apprentice applicants generally must have a high school education or its equivalent. Courses in mathematics, science, and machine-shop work are considered useful preparation for these jobs. Some technical schooling in electricity and electronics is often very desirable. Young men who plan to enter this field should have considerable mechanical aptitude and manual dexterity, and a liking for painstaking work. They should also be capable of visualizing complex mechanical relationships.

As the instrument maker's skill improves and as he broadens his knowledge, he may advance to increasingly responsible positions. About 10 years' experience is required to rise to the top skill level in instrument making. Some instrument makers, with additional training, may be promoted to planning and estimating jobs where their duties will include the determination of time and material requirements for the manufacture of instruments.

Employment Outlook

The number of jobs in this field is expected to expand moderately during the late 1950's and the 1960's. However, the number of openings for new workers will not be large in any 1 year because of the small size of the occupation—probably not more than 10,000 workers were employed as instrument makers in late 1956.

Increasing numbers of instrument makers will be needed in the development of new and improved instruments for industrial and defense purposes. These skilled craftsmen will be needed to work with engineers and scientists who are concerned with the development of instrumentation needed for aircraft, naval vessels, and ordnance materials. However, even without military requirements, our advancing technology requires an increasing use of instruments.

The long-term trend toward the more extensive use of instruments in the petroleum, chemicals, rubber, paper, and food-processing industries is expected to continue. The growth of automation in the metalworking industries will require vast numbers of instruments and control devices. Another source of stepped-up demand for instruments will be the Nation's many research laboratories. Research in biology and medicine, chemistry, physics, meteorology, astronomy, and other fields utilizes a great variety of instruments. The development of atomic energy will also require a considerable number of instruments.

There should be a moderate increase in the number of jobs for instrument makers as a result of the expected expansion in the use of instruments and control devices. However, the number of jobs for instrument makers will grow much less rapidly than the increased output of instruments since these workers are used mainly in the development of new instruments and in the production of instruments to special order, rather than in the mass production of standardized devices. Another factor which may restrict the growth of this occupation is the trend toward a greater use of electrical and electronic components in mechanical instruments which reduces the need for making the mechanical parts.

Most openings for new workers will go, as in the past, to those with experience as machinists or skilled machine-tool operators. There will also be some instrument-maker apprentice openings for young men interested in learning the trade.

In the future, there may be some increased specialization in instrument making so that more of the work will be done by less skilled men working under the direction of all-round instrument makers. This trend has been developing for several years and seems likely to continue. Nevertheless, since such a large part of instrument making is performed in connection with the development of new or very special types of instruments, the possibilities for further specialization are limited and there should continue to be a growing number of jobs for all-round men. Moreover, there will always be a demand for all-

round mechanics to make instruments needed in such small numbers that mass production techniques are impractical. Some openings for new workers will occur as replacements for skilled craftsmen in this trade who die or retire or shift to other fields of work.

Earnings and Working Conditions

Earnings of instrument makers compare favorably with other highly skilled metalworkers. Earnings data obtained from a number of scientific and control instruments manufacturing companies on the East Coast in late 1956 showed hourly earnings of instrument makers generally ranging from $2.40 to $2.75. On the West Coast, these skilled workers were earning between $2.15 and $2.85 per hour in the same period. In the Federal Government, skilled instrument makers were receiving annual salaries ranging from $4,080 to $6,250, with top supervisors being paid up to $7,465 a year.

Instrument-making shops are usually clean and well lighted in order to facilitate precision work. Serious accidents are not common. There is little heavy lifting done by instrument makers. Part of their work is done at benches and part at machines in the shop. Instrument-making shops are usually not noisy because the machines are generally small and not in continuous operation.

Many instrument makers belong to unions, two of which are the International Union of Electrical, Radio and Machine Workers, and the International Association of Machinists.

Welders and Oxygen Cutters

Nature of Work

Welders and oxygen cutters perform important and widely used metalworking operations. Welders join metals by applying intense heat and sometimes pressure to melt the edges so as to form a permanent bond. Welding is an efficient, sure, and economical method of joining metal and is used in both repair and manufacturing operations. Closely related to welding is "oxygen cutting" (also referred to as flame cutting). Oxygen cutters use torches to cut or trim metal objects to a desired size or shape. Flame or oxygen cutting is also used to remove excess metal from castings and to cut scrap metal to manageable pieces.

Of the more than 35 different ways of welding metal, arc, gas, and resistance welding are the three most important. *Arc welders* (D. O. T. 4–85.020) perform their work by either hand or machine methods. *Gas welders* (D. O. T. 4–85.030) usually join metal together by hand operations. Resistance welding is primarily a machine process performed by *resistance-welding operators* (D. O. T. 6–85.010, .020, .030, .060, .100). *Oxygen cutters* (D. O. T. 6–85.215, .240) carry out their work with either hand-guided torches or with oxygen-fuel-gas cutting machines.

The principal duty of the welder using the manual technique is to control the melting by directing the heat, either from an electric arc or from a gas welding torch, and to add filler metal where necessary to complete the joint. In manual shielded metal-arc welding, one of the most commonly used of the arc welding processes, the welder selects a suitable electrode and adjusts controls on power sources which supply the electric current. The welder first "strikes" an arc (draws an electric current) by touching the metal part to be welded with an electrode which also provides the metal filler. By withdrawing the electrode a short distance from the metal part to be welded, an arc is created which bridges the intervening space. After the arc is made, the welder guides the electrode at a suitable distance from the joint seams to be welded. The intense heat caused by the arc melts the metal seams and the electrode tip. The molten metal from the electrode is deposited in the joint and together with the molten metal edges solidifies to form a solid connection.

In gas welding, the welder applies an intensely hot flame (obtained from the combustion of a mixture of fuel gas—most commonly acetylene—and oxygen) from a gas welding torch to the metal edges. After selecting the proper types of welding rods and welding torch tips and adjusting the regulators on the oxygen and acetylene cylinders, the welder lights his welding torch. He then adjusts the oxygen and acetylene valves on the torch to obtain the proper size and quality

of flame. The kinds of flame selected depend on the type of metal to be joined and the type of joint to be made. The welder heats the metal parts to be welded by holding the flame against the metal until it begins to melt. He then applies the welding rod, held in the other hand, to the molten metal to supply additional metal for the weld.

Resistance-welding operators, unlike hand arc and gas welders who use manual methods, operate machines which fuse metal parts by bringing them together under heat and pressure. The operator sets the controls of the machine for the desired electric current and pressure, feeds and alines the work and removes it after the welding operation is completed. The principal types of resistance-welding machines are spot, seam, projection, flash, and upset welding machines and portable spot welding guns.

In the oxygen cutting process, the operator directs a flame of oxygen and fuel gas on the work area until the metal begins to melt. He then releases an additional stream of oxygen to burn or cut the metal. The operator prepares for the cutting job by attaching the proper torch tip for the particular job, connecting the torch to the gas hoses, and regulating the flow of gases into the torch for the desired cutting flame. He then cuts through the metal, guiding the torch manually along previously marked lines or following a template or pattern. He may mark guide lines on the metal himself, following blueprints or other instructions. In some cases, the cutting torch or torches are mounted on a machine which, by electronic or mechanical means, automatically follows the proper line of cut.

Where Employed

In late 1956, about 300,000 welders and oxygen cutters were employed throughout the country. Their principal employers were the manufacturers of boilershop and sheet-metal products, motor vehicle and equipment plants, the aircraft industry, the construction industry, and independent metalworking repair shops. Other important employers of arc, gas, and resistance welders were steel mills, metal-stamping establishments, machinery plants, and railroad shops. Federal, State, county, and city government agencies, such as arsenals, road commissions, and departments of public works, also employed many welders. Among the major employers of oxygen cutters were shipyards, steel mills, machinery, and fabricated structural-steel and boilershop product plants.

Many manual arc and gas welders were employed in maintenance and repair work in railroad shops, electric power plants, street railway systems, and in the maintenance shops of manufacturing plants. Resistance-welding operators are used in production work in metalworking plants where large quantities of identical sheet-metal parts are manufactured.

The widespread use of the welding and cutting processes in American industry enables these workers to find jobs in every State. However, most jobs for welders and cutters are found in the major metalworking areas, with more than 40 percent of them concentrated in Michigan, Pennsylvania, Ohio, Illinois, and California. Large numbers of these workers are employed in Detroit, Chicago, Philadelphia, Los Angeles, and other important metalworking centers.

Training and Other Qualifications

Skills of manual arc and gas welders, resistance-welding operators, and flame cutters vary widely. For most skilled arc- and gas-welding jobs, several years of training and a knowledge of blueprint reading, welding symbols, properties of metals, work planning, electricity, and welding techniques are desirable. Manual dexterity is important. Some of the less skilled manual welding jobs can be learned after a few months of on-the-job training.

Skill requirements for the resistance-welding operator's job depend upon the particular type of equipment used. Most resistance-welding operators learn their work in a few weeks.

Little skill is required for many flame-cutting jobs and they can generally be learned in a few weeks of on-the-job training. However, the cutting of some of the newer alloys requires a knowledge of flame-cutting techniques and the properties of metals.

A course in welding methods, generally in public or private vocational schools, followed by several years of job experience, is the usual way that manual welders learn their trade. Formal apprenticeship training is not often given for this occu-

pation. However, apprenticeship training in many metal crafts includes training in welding as one of the related skills. A few large companies offer apprenticeship programs for welders. The Department of the Navy, at several of its installations, conducts 4-year welding apprenticeship programs for its civilian employees.

The American Welding Society's Code of Minimum Requirements for Instruction of Welding Operators specifies a minimum of 150 hours of actual welding practice and not less than 20 hours of class instruction in welding theory. Experience has shown, however, that a longer period of training is usually necessary to acquire the basic skills.

Young persons entering the welding trade often start with simple manual welding production jobs where the type and thickness of metal, as well as the position of the welding operation, rarely change. Occasionally, they are first given jobs as flame cutters and later move into manual welding jobs. Some large companies employ general helpers in maintenance jobs who may, if they show promise, be given an opportunity to become welders.

After serving as a helper to an experienced welder, a young man may be promoted to a job as a class B welder where he will usually perform repetitive work or work where no critical safety and strength requirements are involved. The work duties of the class B welder are primarily performed in one (flat, vertical, horizontal, or overhead) position. The layout and planning of the work are done by the more highly skilled workers.

The next level of skill experience is the class A or all-round journeyman welder, who plans and lays out work from drawings, blueprints, or other written specifications. The skilled, all-round journeyman welder must have a knowledge of welding properties of steel, stainless steel, cast iron, bronze, aluminum, nickel, and other metals and alloys. He must be able to determine the proper sequence of work operations for each job and be able to weld all types of joints in flat, vertical, horizontal, or overhead positions. Some skilled manual welders are required to know both arc and gas welding. The skilled manual arc welder may be required to perform many types of arc welding, such as shielded metal-arc welding, inert gas metal-arc welding, and stud welding.

When assigned to work where the strength of the weld is a highly critical factor, welders may be required to pass a qualifying examination. The test may be given by an employer, by a municipal agency, a private agency designated by local government inspection authorities, or by some naval facility. Certification tests are also given to welders on some construction jobs or to those who may be engaged in the fabrication or repair of steam or other pressure vessels where critical safety factors are involved. In addition to certification, some localities require welders to obtain a license before they can do certain types of outside construction work.

New developments in some manufacturing industries are increasing the skill requirements of welders. This is particularly true in a field such as atomic energy, which has higher standards for reliability of welds and which calls for more precise work.

Skilled workers may become foremen who supervise the work of other welders. Occasionally, they may be promoted to jobs as inspectors where they check welds for general conformance with specifications and for quality of workmanship. A small number of experienced, all-round welders establish their own welding and repair shops.

Welding is also widely used in maintenance and repair work by members of other crafts. The boilermaker, the structural-steel worker, the machinist, the plumber, and the automobile mechanic all may be required, as part of their job, to know how to weld. Frequently, when welding is used as a repair process, such as in the maintenance shops of large factories, it is done by workers who specialize in welding.

Employment Outlook

The generally favorable long-run outlook in the metalworking industries and the wider utilization of the welding processes are expected to result in a substantial increase in the number of welding jobs in the late 1950's and in the 1960's. This occupation is expected to expand at a faster rate than will the total labor force in this period. Resistance welding, in particular, is expected to grow rapidly because of the increased use of the

machine welding process in such activities as the manufacture of motor vehicles and aircraft, and the production of light, streamlined railroad cars. The demand for resistance welders will, however, be moderated somewhat by the use of more rapid and highly automatic welding machines. The need for maintenance repair work in the growing metalworking industries will require many more skilled manual welders. The number of manual welders engaged in production work is also expected to increase in plants manufacturing structural-metal products, such as metal doors, boilers, and sheetmetal products. The construction industry will also need an increasing number of skilled welders as the use of welded steel structures expands. However, the growth of skilled manual arc and gas welding jobs may be restricted somewhat by the increased use of semiautomatic and automatic welding machines which do not require skilled operators.

The number of jobs for oxygen cutters is expected to rise somewhat during the late 1950's and the 1960's as the result of the general expansion of metalworking activity. The increased use of oxygen-cutting machines, however, will tend to restrict the growth of this occupation.

Replacement needs resulting from deaths, retirements, and transfers to other fields of work will provide many openings for new workers in the welding and oxygen-cutting field. Deaths and retirements alone will result in about 4,000 to 5,000 openings each year.

Earnings and Working Conditions

The amount a welder can expect to earn depends to a great extent on the skill requirements of his job and on the industry or activity in which he is employed. Earnings of highly skilled manual welders generally compare favorably with those of other skilled metalworking occupations. Resistance welders, who require little training, earn much less than the skilled manual welders.

A wage study of the machinery manufacturing industries made by the Bureau of Labor Statistics in the winter of 1955–56 provides some indication of the level of earnings of welders. The average straight-time hourly earnings of hand welders, class A and B, in the cities surveyed are shown above:

City	Hand welders	
	Class A	Class B
Boston	$2.01	$1.76
Baltimore	2.17	1.89
Buffalo	2.26	1.96
Chicago	2.39	2.17
Cleveland	2.35	2.11
Dallas	1.79	1.57
Denver	2.06	------
Detroit	2.49	2.24
Hartford	2.10	1.96
Houston	2.42	------
Los Angeles–Long Beach	2.32	2.06
Milwaukee	2.36	2.06
Minneapolis–St. Paul	2.14	1.94
Newark–Jersey City	2.48	2.07
New York	2.12	1.92
Philadelphia	2.40	------
Pittsburgh	2.42	2.20
Portland (Oreg.)	2.27	------
San Francisco–Oakland	2.25	------
St. Louis	2.63	2.00
Worcester	2.12	1.93

Average straight-time hourly earnings for skilled (class A) manual welders in the 21 selected cities ranged from $1.79 to $2.63, with the highest rates in St. Louis ($2.63) and Detroit ($2.49). Semiskilled (class B) manual welders' average hourly earnings ranged from $1.57 to $2.24.

Many welders are union members. Among the labor organizations which include welders in their membership are the International Association of Machinists; the International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers; the International Union, United Automobile, Aircraft and Agricultural Implement Workers of America; and the United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry.

Many welders and cutters are employed in plants which have labor-management contracts. Most of these agreements provide employees with major benefit programs which may include hospitalization, medical and surgical insurance, life insurance, sickness and accident insurance, or a retirement pension.

Welders and cutters are exposed to a number of hazards in their work. However, safety training,

protective devices, and special clothing have kept the injury rate relatively low. Protective goggles, or helmets with colored lenses, protect welders from burns and welder's flash (a temporary eye injury caused by exposure to harmful light rays). Suitable clothing also protects the welder's skin from the rays. Although lighting and ventilation are usually adequate, welders occasionally work in the presence of toxic gases and fumes generated by the melting of some metals. Welders are often in contact with rust, grease, paint, and other elements found on the surface of the metal parts to be welded. Resistance-welding operations are largely free from the hazards associated with the hand methods. A clear eye shield or clear goggles generally offer adequate protection to resistance welding operators.

Where To Go for More Information

The American Welding Society,
33 West 39th St., New York 18, N. Y.

International Association of Machinists,
1300 Connecticut Ave. NW., Washington 6, D. C.

International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers,
8th at State Ave., Kansas City 11, Kans.

International Union, United Automobile, Aircraft and Agricultural Implement Workers of America,
8000 East Jefferson Ave., Detroit 14, Mich.

United Association of Journeymen and Apprentices of the Plumbing and Pipe Fitting Industry of the United States and Canada,
1200 18th St. NW., Washington 6, D. C.

State Supervisor of Trade and Industrial Education or the local Director of Vocational Education in the State and/or city in which a person wishes to receive training.

Some Major Industries and Their Occupations

OCCUPATIONS IN AIRCRAFT MANUFACTURING

The vital importance of aircraft to national defense and the wider use of civilian air transportation have made the manufacture of aircraft one of the important industries in our economy. The aircraft industry was the largest manufacturing industry in the United States in mid-1956, employing more than 800,000 workers. Between 1948 and 1956, the industry expanded its employment more than threefold and developed and produced new aircraft models at an unprecedented pace. It provided the United States Armed Forces with many faster than sound piloted aircraft and various types of guided missiles. It also built larger and better airplanes for commercial airlines.

The industry employs workers in jobs requiring a wide range of training and experience. The nonplant workers in this industry make up a higher proportion of total employment than in most other manufacturing industries. This is due primarily to the large amount of research and development work carried on in the aircraft industry. It is one of the largest employers of engineers, scientists, and technicians. The industry also provides thousands of jobs for skilled metalworkers, such as tool and die makers, sheet metal workers, and welders. Many skilled maintenance workers, such as electricians, millwrights, machinery repairmen, and pipefitters, are also employed in aircraft plants. However, assemblers make up the largest occupational group of workers employed by the industry. Training requirements for jobs in the aircraft industry range from a few days of on-the-job training for some assembling jobs to graduate college degrees for some scientific jobs.

Nature and Location of the Industry

The aircraft industry produces both piloted aircraft and guided missiles. Piloted aircraft include fixed-wing airplanes and helicopters. These may be powered by several kinds of aircraft engines. Guided missiles range in size from relatively small projectiles carried and fired from airplanes to much larger models fired from the surface of the earth and from ships or submarines. Missiles are powered by rocket, ramjet, or turbojet engines.

About 90 percent of the industry's 1956 production consisted of military aircraft and guided missiles. A large proportion of the remainder was aircraft for commercial air transportation. The industry also produces many smaller airplanes used for business, pleasure, and instructional flying.

The industry is composed of four separate and distinct branches. The airframe branch, turning out the completed aircraft, is by far the largest, employing in excess of 550,000 workers in late 1956. The workers in this branch design the aircraft, fabricate most of the airframe, and assemble and test the completed product. Engines, propellers, aircraft sections, and auxiliary equipment made in other branches of the aircraft industry, as well as electronic equipment and thousands of different parts made in plants outside the aircraft industry, are sent to the airframe plants for final assembly.

The second major branch of the industry consists of the aircraft-engine plants in which reciprocating, turboprop, turbojet, ramjet, and rocket engines for aircraft are produced. These plants, which employed more than 175,000 workers in late 1956, accounted for about 20 percent of total aircraft employment.

Aircraft-parts plants make up the third major branch, having a work force of about 115,000 in late 1956. These plants manufacture a variety of parts such as wing and tail sections, gas tanks, landing gears, refrigeration systems, and other auxiliary equipment.

By far the smallest branch, employing about 18,000 workers in late 1956, is composed of plants which produce the many kinds of aircraft propellers.

Although aircraft manufacturing employment is distributed among 40 States, almost one-third of the employees work in California. Forty percent are employed in Ohio, New York, Connecticut, Texas, Washington, and Kansas. Some of the

metropolitan areas with heavy concentrations of employment are Los Angeles, New York, Seattle, San Diego, Wichita, Hartford, Fort Worth, and Dallas.

There is substantial airframe employment on the West and East Coasts. Texas and several other States also have a large share of this employment. The geographical pattern of aircraft-parts employment is similar to that of airframe employment. On the other hand, aircraft-engine employment is concentrated on the Northeast Coast and in the Midwest. The geographical distribution of propeller manufacturing employment is generally similar to that of aircraft-engine employment.

Young people interested in employment in the aircraft industry can expect to work in large plants. For example, about half of all airframe plants employed 5,000 or more workers each in late 1956. Aircraft-engine plants are generally smaller, but many of the plants had more than 1,000 employees and a few had more than 5,000.

How Aircraft Are Made

The following brief description of how aircraft are made is presented to give the reader a better understanding of the type of jobs found in this industry. First, the design engineering department of the airframe company tentatively designs the model based upon specifications furnished by the military agency or civilian purchaser. A scale model is built and tested. After these tests, the full sized craft is designed. An experimental or prototype aircraft is then built which undergoes rigorous tests both in the air and on the ground. Any flaws found are corrected. When the aircraft passes all tests satisfactorily, data on its performance and characteristics are made available to the prospective buyer. If the prototype is acceptable, contracts are awarded and the airframe company can plan manufacturing operations.

The thousands of details required to set production in motion are then worked up. The engineering department furnishes drawings and data to the planning department, which is responsible for production plans. A list is made of tools, machinery, parts, blueprints, materials, and operations required for making each part. On the basis of this information, orders are sent to the purchasing department for whatever items are required.

The assembly of aircraft is the airframe plant's primary production activity. It is estimated that more than 60,000 subcontractors and suppliers provide the thousands of components which airframe plants require to produce a completed plane. The factories producing the components perform a wide variety of manufacturing operations such as metalworking, electrical, and assembly work. For example, engine plants are essentially precision metalworking establishments. The biggest part of their work consists of machining metal parts with power-driven machine tools. Since they often perform machining operations on metal parts which have been forged or cast, they either maintain their own forge shops or foundries or have their forging or casting work done for them by outside establishments on a contract basis. Plants producing the new jet engines perform relatively more sheet-metal work and do less machining than plants manufacturing reciprocating engines. Propeller plants are similar to engine plants in that they are essentially metalworking shops.

Production begins in the airframe plant as soon as the machinery and tools are in place, the work force instructed, and materials and parts begin to flow in. In addition to performing assembly work, the airframe plants fabricate wings, fuselage, and tail. This involves the cutting, forming, heating, and processing of stainless steel, aluminum, titanium, and aluminum alloys to produce thousands of different parts. These parts are brought together to form sections of the plane at various bench and floor assembly work stations.

Major assembly is performed in the airframe plant. After the fuselage is constructed, the wings and tail are joined to it and the power plant (engine) installed. There is extensive riveting and bolting in joining the various sections of the aircraft together. The auxiliary equipment, such as fuel and hydraulic systems, and flight controls, is usually installed during the later stages of assembly. Before the aircraft is considered complete, it is "reworked" for last minute engineering changes.

The aircraft is now ready for test flights. These tests are the last and most searching of the numerous inspections which occur at every stage of the aircraft's construction from fabrication of components to final assembly. After the aircraft passes its flight check satisfactorily, it receives a final checkup and is then prepared for delivery.

Occupations in Aircraft Manufacturing

Workers with a great variety of skills and training are needed to manufacture aircraft. The industry employs engineers and scientists with advanced college degrees as well as plant workers who can learn their jobs after a few days or weeks of training. The aircraft industry is also one of the largest employers of women. In October 1956, 135,000 women were employed in a wide variety of "white collar" and factory jobs.

The industry's emphasis upon research and development and the constant changes in design and production methods make it an important employer of engineers, scientists, draftsmen, and other technical workers. A study of science and engineering in American industry made by the Bureau of Labor Statistics for the National Science Foundation showed that the aircraft industry, in 1954, exceeded all other industries in money spent on research and development, in the proportion of its scientists and engineers engaged in research and development activity, and in the ratio of supporting personnel used to assist scientists and engineers.

Assemblers, sheet-metal workers, machine-tool operators, tool and die makers, and inspectors are among the important occupations found in this industry. In addition, large numbers of maintenance workers, such as machinery repairmen, electricians, millwrights, and pipefitters, are also employed in the aircraft industry.

Differences in production activities of the four branches of the aircraft industry have resulted in somewhat different occupational reqirements. For example, nearly 22 percent of the workers in airframe plants are employed as assemblers because assembly is the primary production activity of this branch of the industry. Since many of the jigs, fixtures, and tools required for airframe production are made in airframe plants, 7 percent of its employees are engaged in tool fabrication. More than 18 percent of the workers in airframe plants were in professional and technical jobs in late 1956, with a large proportion of these workers engaged exclusively in research and development. The following is a percentage distribution of airframe workers among major occupational groups in late 1956:

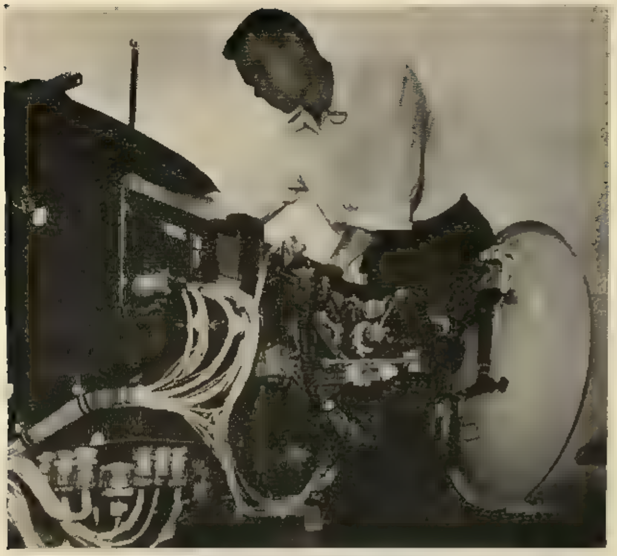
	Percent of total employment
Total employment	100.0
Nonplant workers	35.2
Managerial and supervisory	5.0
Professional and technical	18.5
Clerical and stenographic	11.7
Plant workers	64.8
Maintenance, repair, and power	4.1
Tool fabrication, pattern shop, and allied	7.1
Machining	4.5
Fabricating and processing	10.8
Assembly	21.5
Inspecting and testing	4.5
Field service and flight line	5.1
Other plant workers	7.2

In contrast, the aircraft engine branch employs a relatively larger proportion of machine tool operators because machining is its largest production activity. About 12 percent of its workers were in machining jobs and 9 percent were in inspecting and testing jobs. More than 12 percent of the aircraft engine industry's employees were in professional and technical jobs in late 1956 because research and development is also a major activity in this segment of the industry. The following is a percentage distribution of aircraft engine workers among major occupational groups:

	Percent of total employment
Total employment	100.0
Nonplant workers	38.7
Managerial and supervisory	7.8
Professional and technical	12.4
Clerical and stenographic	12.0
Other nonplant workers	6.5
Plant workers	61.3
Maintenance, repair, and power	6.9
Tool fabrication	3.8
Machining	11.9
Fabricating and processing	6.2
Assembly	4.7
Inspecting and testing	9.1
Other plant workers	18.7

Aircraft-parts manufacturing plants carried on much less research and development work than the other branches in the industry and consequently employed a smaller proportion of professional and technical workers. Sheet metal, machining, and assembly are the major production operations in parts plants.

The following is a description of some of the more important jobs found in the aircraft industry.



An electronic technician making final adjustments on an armament control system prior to flight tests.

Professional and Technical Occupations

Before an airplane can be made and assembled by the various branches of the industry, it must be designed and its production planned. Engineering and scientific personnel, working in laboratories and using such research and testing devices as wind tunnels, prepare the plans and specifications for the complete design as well as for the many component parts of the airplane. Among the professional people employed in this industry are *aeronautical* (D. O. T. 0–19.03), *civil* (D. O. T. 0–16.01), *electrical and electronic* (D. O. T. 0–17.01), *industrial* (D. O. T. 0–18.01), and *mechanical engineers* (D. O. T. 0–19.01); *physicists* (D. O. T. 0–35.73); *metallurgists* (D. O. T. 0–14.20); *chemists* (D. O. T. 0–07.80); and *mathematicians* (D. O. T. 0–35.76). Engineers and scientists are assisted in their work by *engineering aids*, *laboratory technicians*, and *electronic technicians* (D. O. T. 5–83.444). *Draftsmen* (D. O. T. 0–48.04) develop design plans in detail in the form of blueprints and specifications.

Other engineering experts specialize in planning the most efficient methods of organizing production. They are concerned with plant layout, selection and installation of machinery, and storage and movement of materials and parts within the plant. Among those engaged in production planning and control are *production planners* (D. O. T. 0–68.50) and *methods planners* (D. O. T. 0–18.01) who generally serve as liaison men between the engineering and production departments in a plant. Working from information obtained from blueprints and various kinds of engineering specifications they plan the arrangement of production machinery and the sequence of operations necessary to fabricate, assemble, and install aircraft parts. Since production planners work on both engineering and production problems, they must be able to apply some engineering principles and also have a working knowledge of shop practices.

Tool designers (D. O. T. 0–48.41) resign tools, jigs, fixtures, and special machines used in fabrication and assembly on the basis of planning information, engineering drawings, and other data. *Technical illustrators* (D. O. T. 0–48.32) and *technical writers* (D. O. T. 0–06.90) produce the technical manuals and literature which are used to describe the operation and maintenance of aircraft and their manifold parts. They work closely with engineers. (More detailed discussions of individual professional and technical occupations are given elsewhere in this Handbook. See index for page numbers.)

Managerial and Clerical Occupations

Managerial and supervisory jobs in the aircraft industry are generally comparable to similar jobs in other industries. Personnel in these jobs include executives, who are responsible for the management and supervision of research and production operations, and officials in such departments as sales, purchasing, accounting, public relations, advertising, and industrial relations.

The industry also employs many thousands of clerks, secretaries, typists, stenographers, tabulating machine operators, and many other office personnel. (Duties in these jobs are similar to those in other industries and are described elsewhere in this Handbook. See index for page numbers.)

Plant Occupations

Nearly 65 percent of the workers in aircraft manufacturing were employed in plant jobs in late 1956. Plant jobs can be classified into the following groups: assembly and installation, sheet metal, tooling and machining, other metal processing, flight line and airport mechanics, inspecting and testing, maintenance and custodial, and all other plant jobs.

Assemblers working inside a large plane putting insulation materials in place.

Assembly and Installation Jobs. Assembly and installation workers are numerically the largest occupational group in aircraft and parts manufacturing—accounting for about 20 percent of the industry's total employment. Although these workers are employed in all branches of the industry, most assembly jobs are found in the airframe plants.

A wide variety of assembly jobs exists, even within one airframe plant, because assembly is really not a single occupation, but a family of jobs, all having the same general purpose and using similar methods. Some assemblers are skilled, all-round workers, but a large proportion are semiskilled workers doing repetitive work. The more skilled assemblers in airframe factories perform diversified assembly or installation work. They must be able to read blueprints and interpret other engineering specifications. The all-round assembler is usually employed in final assembly work where major subassemblies, such as tail, fuselage, and wings, are fitted together and the major installations are made. They are also employed in producing prototypes and experimental aircraft.

The division of duties among assemblers in a particular plant depends largely on the organization of the production line. Plants which are engaged in the quantity production of aircraft, rather than a few experimental types, usually require even their skilled assemblers to specialize in one or more fields of work. They are often assisted by less skilled assemblers who do the routine work. For example, a *class A armament assembler* (D. O. T. 5–83.543) typically does such work as assembling, installing, and alining power turrets, weapons, mechanisms, gun cameras, and related accessories. Lower rated armament assemblers typically do such work as uncrating and cleaning weapons, loading ammunition, installing armor plate, and placing parts in jigs. Skilled *electrical assemblers* (D. O. T. 4–97.910), sometimes called electricians, do such work as installing, hooking up, and checking major units in electrical or radio systems. They are assisted by less skilled assemblers, who do the more routine installations and wire routings by following standard wiring diagrams and charts. *Power plant assemblers* (D. O. T. 5–03.572), sometimes known as engine mechanics, install, aline, and check the various types of engines and accessories. Assemblers also specialize in plumbing, hydraulic, and various surface control and rigging systems.

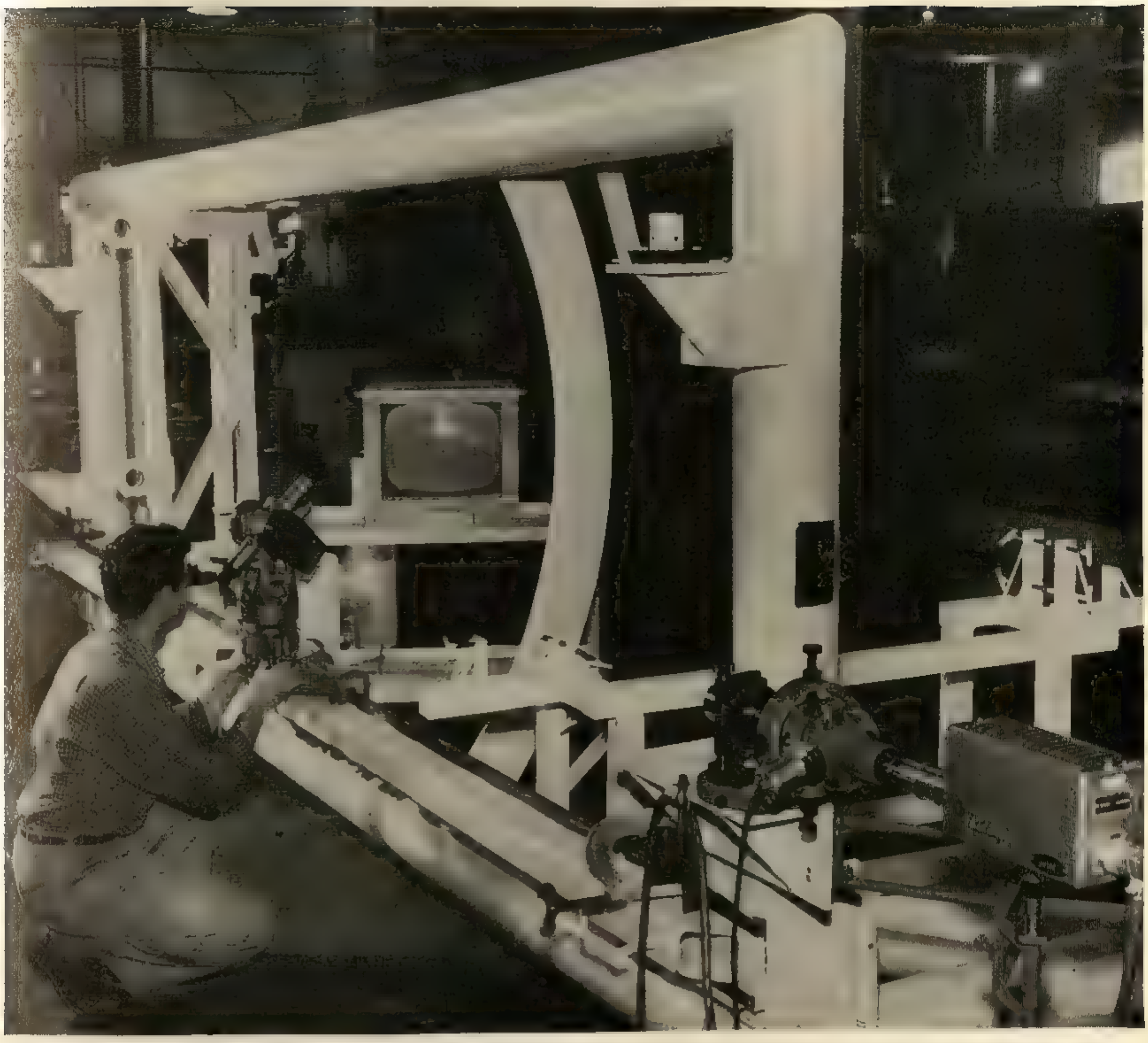
Assembly work in aircraft-engine and aircraft-parts factories differs to some extent from the assembly operations in airframe plants. Assembly operations are usually divided into bench and floor assembly in aircraft-engine plants. The numerous small parts used in aircraft engines are fitted together into subassemblies by bench assemblers. These subassemblies are then brought together on the floor of the factory, where a crew of floor assemblers, usually consisting of a skilled assembler and several less skilled workers, then fit them together.

Sheet-Metal Jobs. Sheet-metal workers shape metal aircraft parts from sheet metal by hand or machine methods. Where hand methods are used, the worker shapes the part by pounding it with a mallet and by bending, cutting, and punching it with handtools. Machine methods involve the use of power hammers and presses, saws, tube benders, and drill presses. The all-round sheet-metal worker lays out the sequence of operations from blueprints and other engineering information. He then fabricates complicated metal shapes by hand or power machine. Less complex parts, as well as those which are produced in large numbers, are fabricated by less skilled sheet-metal

Assemblers complete Navy jet fighters on final assembly line in huge aircraft plant.

workers or workers who specialize in operating a single machine and have such job titles as *stretch press operator* (D. O. T. 4–88.627), *power brake operator* (D. O. T. 6–94.207), *power hammer operator* (D. O. T. 6–94.221), *power shear operator* (D. O. T. 6–88.664), *punch press operator* (D. O. T. 6–88.622), and *profile cutting torch operator* (D. O. T. 6–85.240).

Tool Fabrication and Machining Jobs. Although the total number of workers employed in tool fabrication is not large compared with other operations in aircraft production, tool fabrication is one of the major operations in aircraft manufacturing where skilled workers are required. The two principal occupations in tool fabrication are *jig and fixture builders* (D. O. T. 5–17.060) and *tool and die makers* (D. O. T. 4–76.010, .040, and .210). Jig and fixture builders are mainly employed in the airframe plants to make jigs and fixtures, the work-holding and tool-guiding devices used in production and assembly operations. These skilled workers must be able, based upon information received from the engineering department, to plan a sequence of metal machining operations involved in making a jig. They must be able to lay out the work and carry the job through to completion. Tool and die makers make the cutting tools and fixtures used in machine tool operations and the dies used in forging and punch press work. They must be all-round experts in the use of machine tools.



Jig and fixture builder using optical instruments to construct a work-holding jig to be used in assembling a section of the airframe

Another large group of workers in the aircraft manufacturing industry engaged in shaping and finishing metal parts with machine tools are *machinists* (D. O. T. 4–75.010) and *machine-tool operators.* These workers make up a greater proportion of the work force in engine and parts plants than in airframe plants.

The most skilled among these workers are the all-round or general machinists who can lay out the work and set up and operate several types of machine tools. They perform machining operations on highly variable and nonrepetitive work. They are most frequently employed in departments which are engaged in experimental and prototype production.

Machine-tool operators are employed in the large volume production of metal parts. They generally specialize in the operation of a single type of machine tool. The more skilled machine-tool operators are able to set up the work on their machine and handle difficult, precise, and variable jobs. The less skilled operators usually do more repetitive work. (A more detailed discussion of tool and die makers, machinists, and machine-tool operators is given in the section on machining occupations. See index for page numbers.)

The aircraft industry also employs other metalworkers such as tube benders, riveters, and welders. The *tube benders* (D. O. T. 6–95.060) form tubings which are used for oil, fuel, hy-

Milling machine operator cutting ribs in an aluminum metal plate which will become an aircraft wing panel.

draulic, and electrical conduit lines. *Riveters* (D. O. T. 6–95.080) and *welders* (D. O. T. 4–85.020, .030, .040, and .063) join fabricated parts together by hand or machine riveting and by electric arc, gas, or electric resistance welding.

Flight Line and Airport Mechanics. These workers prepare the airplane for its test flight after the final assembly operations have been completed. They look for flaws in the construction or functioning of the airplane and make necessary repairs before final delivery or recommend that it be returned for further rework in the factory before final delivery. They may also be required to go up on test flights in the performance of their duties. Some of these workers are temporarily assigned as service mechanics to Air Force bases to instruct military personnel in the servicing of new model planes.

The job of preparing an airplane for its first flight requires a team of mechanics with different levels of skill and experience. The *chief mechanic* or *crew chief*, who is the most skilled among these workers, is responsible for the entire checking-out operation and repair work. He usually supervises a crew of mechanics, each of whom specializes in one or more fields. For example, *engine mechanics* specialize in checking-out the power plant of the aircraft, including the engine, propellers, and oil and fuel systems. The engine mechanic subjects the power plant to various tests during its operation so as to determine whether it is operating correctly. He uses handtools, testing equipment, and precision measuring instruments in his work.

Flight line and airport mechanics may also specialize in the checking-out and repairing of electrical systems, armament, instruments, rigging and controls, and the plumbing and hydraulic systems of the airplane. In some cases, less skilled mechanics are employed to assist the specialized mechanics in conducting their tests and making minor repairs.

Inspecting and Testing Jobs. Because airplanes are extremely complex, thousands of inspections must be made during their manufacture. Raw material is inspected as it is received in the plant and additional inspections are made throughout the many fabricating and assembly operations until the plane has completed its first flight.

The inspectors' job is to examine the parts and assembled units of the aircraft in each stage of its manufacture to see that all engineering requirements have been met. Some inspectors specialize in examining materials, parts, equipment, or subassemblies purchased from the outside; others inspect parts during various stages of fabrication and final assembly within their own plants; while still others inspect the completed aircraft after it has been rolled out onto the field in preparation for its initial test flight.

Some of the most skilled inspectors, especially in airframe plants, are the *outside production inspectors* (D. O. T. 4–76.220) who examine machine parts, subassemblies, and tools and dies which have been ordered from other firms. They also serve as liaison men between their own engineering departments and the contracting companies. Other inspectors, frequently known as *receiving inspectors* (D. O. T. 7–03.810), with less responsibility than outside production inspectors, check purchased materials and parts for conformity with blueprints, Air Force and Navy requirements, and other established standards. They operate testing equipment and must be familiar with specifications of the parts and materials purchased from different sellers. The *machine parts inspector* (D. O. T. 4–78.671) in the production department determines, by the use of precision testing instruments, whether or not a part has been properly

machined to conform to blueprint specifications. His duties may also include testing for hardness and porosity, checking the finished parts against the rest of the assembly, and determining the "machineability" of castings and forgings.

Fabrication inspectors (D. O. T. 5–03.812) are generally former skilled sheet-metal workers. These workers inspect fabricated sheet metal work, examine first run assemblies and developmental parts, and make the final inspection of complex parts which have required numerous fabricating operations.

As the parts are fitted together, they undergo numerous inspections by the *assembly inspector* (D. O. T. 5–03.814). Assembly inspectors are employed, for the most part, in the later stages of the assembly process. They usually inspect complete major assemblies and installations, such as fuselage, wing, and nose sections, to insure their proper final fitting. They also check the functioning of such systems as hydraulics, plumbing, and controls. Subassemblies are usually inspected by less skilled assembly inspectors.

Maintenance and Custodial Jobs. These workers are employed to keep machinery, equipment, and buildings in good operating condition and to make changes in the layout of the plant. Included among these workers are *maintenance mechanics*, *millwrights*, *electricians*, *carpenters*, *plumbers*, and *pipefitters*. *Guards*, *firemen*, and *janitors* are also part of the plant protective and custodial group. (Detailed discussions of some of these occupations are included elsewhere in this Handbook. See index for page numbers.)

Other Plant Workers. Because of the great amount of metal fabricating involved in the manufacture of aircraft, many metal workers in addition to those mentioned previously are employed in aircraft plants. Included among these are those engaged in foundry work such as *patternmakers* (D. O. T. 5–17.248), *molders* (D. O. T. 6–81.090), and *coremakers* (D. O. T. 4–82.010). *Drop hammer operators* (D. O. T. 4–86.110) and other forge shop workers are found in the forging departments. Most plants also employ *tool crib attendants* (D. O. T. 1–38.05) and *stock clerks* (D. O. T. 1–38.01) to keep the production workers supplied with tools, parts, and materials.

Training, Other Qualifications, and Advancement

A college degree in engineering or in one of the sciences is generally the minimum requirement for engineering and scientific jobs. For some scientific jobs—particularly those in the area of research and development work—persons with advanced degrees or the equivalent in work experience are essential. (Detailed discussions of the training and other qualifications for individual engineering and scientific occupations are presented elsewhere in this Handbook. See index for page numbers.) Many college graduates without previous experience are hired for these jobs and are given additional training in company-sponsored training programs. Some companies offer technical instruction at their own plants or at nearby colleges to fit new employees into their organization or to give further training for personnel already employed. Some companies reimburse engineers and other technical workers for tuition costs of specialized technical courses taken at local colleges or universities. In addition, aircraft companies have management development programs to train their technical and other personnel for supervisory and executive positions.

The aircraft industry employs thousands of semiprofessional workers (technicians) such as production planners, tool designers, electronic technicians, engineering aids, and draftsmen. In many cases, these workers are trained in 2-year technical institute or junior college programs sponsored by the aircraft companies. Not all employers require formal technical training for skilled tool, experimental, and production designers or planners. In some cases, several years of diversified shop and tool planning experience have enabled some workers to qualify for these jobs. However, it is becoming more common for these workers to have at least 2 years of formal training.

The training requirements for plant jobs vary from a few days of on-the-job experience to 4 or 5 years of formal apprenticeship training. Aircraft firms have apprenticeship programs for such skilled occupations as tool and die makers, machinists, sheet-metal workers, aircraft mechanics, electricians, and patternmakers.

During the apprenticeship period, which generally lasts about 4 years, the apprentice works with the tools of his trade, doing work of progressively increasing difficulty. In addition to

work experience, the apprenticeship programs usually include related classroom instruction.

According to a recent survey of training made by the U. S. Department of Labor's Bureau of Apprenticeship and Training, about one-third of the aircraft plants had apprenticeship training programs in 1955. In addition to depending upon apprenticeship programs as a source of skilled labor, many aircraft plants fill their skilled jobs by upgrading workers who have picked up the skills of their trade by working with experienced craftsmen.

A wide range of training and experience is required for other factory jobs in the aircraft industry. For example, workers with little or no previous training or experience are hired for the less skilled assembly jobs. On the other hand, some skilled assemblers are required to have from 2 to 4 years of aircraft plant experience in addition to the equivalent of a high school or vocational school education. These skilled assemblers must be able to read and interpret engineering blueprints, schematic diagrams, and production illustrations. Many aircraft firms give short-term courses to assembly workers to teach them to read blueprints and schematic diagrams.

The kind and length of training required for inspection jobs depends largely on the field in which the inspecting is being done. Customarily, the more skilled inspectors gain their basic experience and training in one of the aircraft manufacturing shop trades. For the less skilled inspection jobs, new workers with limited or no experience in shop trades may be hired and trained directly as inspectors.

The highest skilled inspectors who examine the parts manufactured by outside suppliers and parts machined in their own plant must have had at least several years of machine shop experience. Skilled inspectors must also be able to install and use the various testing equipment and instruments used in their field of work. As part of their duties, these inspectors must be able to read blueprints and other engineering specifications and use shop mathematics. Many new workers are taught blueprint reading and shop mathematics in training programs conducted or sponsored by the aircraft companies.

Chief flight line and airport mechanics are usually required to have from 3 to 5 years of aircraft manufacturing experience, including at least 1 year as a field and service mechanic. Specialized mechanics, working under the supervision of the chief mechanic, are usually required to have 2 or more years of aircraft experience. Workers with little or no experience in the aircraft industry are sometimes hired as helpers or assistants to specialized mechanics and pick up the skills on the job.

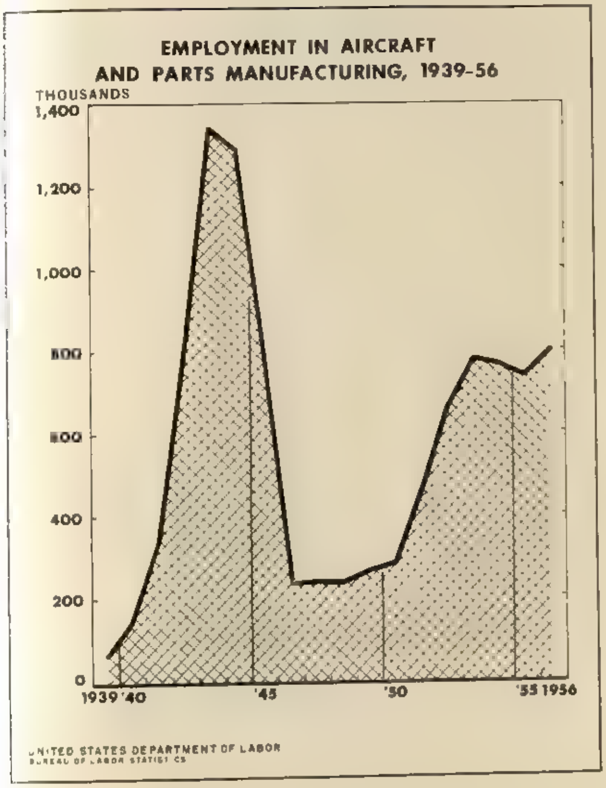
Mechanics, especially chief mechanics, frequently acquire most of their experience in production departments before becoming flight line and airport mechanics. Workers can qualify for the higher rated field and service mechanics jobs in different ways. They can take a beginning job as a less skilled mechanic and may advance as they gain experience. Those who have completed high school or vocational school may be eligible for training jobs which are offered by some of the aircraft plants. The higher rated jobs are also sometimes filled by experienced "line maintenance" mechanics who have been employed by airlines.

Employment Outlook

The employment opportunities in the aircraft manufacturing industry in the late 1950's and the 1960's will depend largely on the size of the Government's military aircraft procurement program. (In 1956, an estimated 90 percent of the industry's production consisted of military aircraft and guided missiles for the Armed Forces.) The aircraft industry can be expected to provide many thousands of job opportunities for new workers in the next decade, unless the international situation should change substantially from that which prevailed at the end of 1956, and bring with it a reduction in military procurement. Many of these job openings will result from the need to replace workers who die, retire, or transfer to other fields of work. Deaths and retirements alone will result in about 13,000 to 16,000 job openings annually.

Since 1940, the aircraft industry has experienced several periods of expansion and contraction which have affected the kind as well as the number of workers employed in the industry. Chart 44 shows that, in the short span of 3 years, between 1940 and 1943, the industry increased its employment almost tenfold in order to meet the demands of war production. By November 1943, aircraft and parts establishments employed more

CHART 44



than 1,450,000 workers. After the peak employment of World War II was reached at the end of 1943, the number of workers employed in this industry decreased steadily until the end of hostilities.

The end of the war brought about a much sharper reduction of employment. Between 1945 and 1946, aircraft employment dropped from 788,000 to 237,000. From 1946 to 1950, employment remained fairly stable. The Korean hostilities resulted in a sharp rise in employment. The number of workers increased from about 282,000 in 1950 to 464,000 1 year later and continued to rise thereafter. By September 1956, this industry with 830,000 workers on its payroll was the largest employer among all American manufacturing industries.

Indications are that defense expenditures will probably increase during the 1956–66 decade and that appropriations for military aircraft and guided missiles will make up a larger percentage of the total military budget during this period. Some increase in aircraft industry employment thus seems likely. Although manpower requirements for production of military piloted planes are expected to decline somewhat in the next few years because planned expansion will have been achieved for this equipment, manpower requirements for guided missile production will probably expand sharply and more than offset the decline of piloted aircraft. Although small plane production will probably continue to increase, primarily because of the expanded need for planes used in business flying, the industry's employment devoted to civilian aircraft production is expected to remain near current levels in the 1956–66 decade.

The anticipated growth of the aircraft industry will particularly increase the industry's need for workers in certain occupations. For example, an expansion in research and development activity is expected because of the industry's established pattern of pioneering in developing new and better products and continually emphasizing improved manufacturing techniques. It is expected that there will be many employment opportunities for all types of engineers, production planners, tool designers, electronic technicians, and technical illustrators.

The industry's requirements for skilled tool and die makers and machine-tool operators are expected to increase because of the emphasis upon the manufacture of metal items made to precise machining dimensions. The increased use of steel and titanium will require new knowledge, skills, and techniques from machining workers. Additional maintenance and repair workers will be needed to maintain the industry's more complex and growing amount of machinery and equipment.

Earnings and Working Conditions

The earnings of plant workers in the aircraft industry are higher than in most other manufacturing industries. In December 1956, production workers in aircraft and parts manufacturing plants earned an average of $100.15 a week and $2.34 an hour. This compared with an average of $84.05 a week and $2.05 an hour for all manufacturing industries in the same month.

Little information is available on the earnings of professional and technical personnel in the aircraft industry. However, earnings data for many of these occupations in industry as a whole are included in the sections on individual occupations in this Handbook. (See index for page numbers.)

The following tabulation, based upon information collected from a number of large aircraft manufacturers, indicates the general range of hourly rates for selected occupations in mid-1956:

Laboratory technicians	\$2.00–\$2.70
Electronic technicians	2.00– 2.70
Tool planners	1.85– 2.90
Tool designers	2.15– 2.95
Assemblers	1.55– 2.45
Sheet metal workers	1.60– 2.70
Machinists	2.00– 2.75
Machine tool operators	1.65– 2.45
Tool and die makers	2.05– 2.75
Jig and fixture builders	2.10– 2.70
Aircraft mechanics	1.95– 2.70
Field and service mechanics	2.00– 2.60
Inspectors and testers	1.75– 2.65
Maintenance craftsmen	1.85– 2.70

Most workers in the industry receive 1, 2, or 3 weeks' vacation with pay, depending on their length of service. The majority of firms give their employees seven paid holidays a year. Workers are also generally covered by medical, health, accident, life insurance, and pension plans.

Most employees in the aircraft manufacturing industry work in modern factory buildings which are clean, well lighted, and well ventilated. In California and Texas, many aircraft employees work outdoors. This industry is a relatively safe place to work compared with other manufacturing industries. The work of safety departments and joint labor-management safety committees has resulted in decreasing injuries in recent years. In 1955, the aircraft industry averaged 3.5 disabling injuries for each million employee hours of work. This compares with an average of 12.1 for all manufacturing industries.

A very large proportion of production workers in the aircraft industry are members of unions. The International Association of Machinists and the International Union of United Automobile, Aircraft & Agricultural Implement Workers of America represent many of these workers. Several independent unions also have contracts with aircraft plants. In addition, some guards, truck-drivers, and craftsmen are members of unions representing workers in their particular occupational group.

Where To Go for More Information

Aircraft Industries Association of America, Inc.
Shoreham Bldg., 15th and H Sts., NW.,
Washington 5, D. C.

International Association of Machinists,
1300 Connecticut Ave. NW., Washington 6, D. C.

International Union of United Automobile, Aircraft & Agricultural Implement Workers of America,
East Jefferson Ave., Detroit 14, Mich.

OCCUPATIONS IN THE AIR TRANSPORTATION INDUSTRY

The Air Transportation Industry and Its Workers

The air transportation industry has become one of the Nation's major passenger transportation industries in the period since World War II. In 1955, airlines carried more than a fourth of the intercity commercial passenger traffic. The nearly 20 billion domestic passenger miles flown by the scheduled airlines in 1955 was about 2½ times the amount flown in 1950. By mid-1956, the air transportation industry had more than 150,000 employees on its payrolls. The industry provides employment opportunities for a growing number of workers in a variety of highly skilled and responsible jobs. Some of these jobs, such as pilots and stewardesses, are especially appealing to young men and women.

Nature and Location of Industry

The scheduled airlines (those which operate a regular schedule of flights over prescribed routes) employed more than 90 percent of air transportation workers in 1956. Twelve of the 54 scheduled airlines were large domestic trunk lines which provided regular service over heavily traveled routes connecting large metropolitan areas; 8 of these large airlines also operated international routes. In addition, 10 other airlines were engaged exclusively in international operations. Domestic local service lines (those which connect the major traffic centers with cities off the main routes) were operated by 13 airline companies. Thirteen small carriers operated only in the Territories. Six carriers handled cargo exclusively.

More than 50 nonscheduled airlines (those which do not have Civil Aeronautics certification to run regularly scheduled flights) accounted for only about 3 percent of employment in the air transportation industry in 1956. A few of the larger nonscheduled companies are located in large metropolitan centers and carry passengers along the same routes used by the major scheduled airlines. However, the majority of the nonscheduled lines are small companies which run flights on a charter basis, between communities off the main scheduled airline routes.

The rules and regulations governing the operation of air transportation in the United States are established by the Civil Aeronautics Board and enforced by the Civil Aeronautics Administration—both agencies of the United States Government. The CAA inspects and tests airplanes and airline facilities, investigates accidents, gives tests, and licenses some personnel. The CAA employs several hundred men trained as pilots, aeronautical engineers, radio operators, and airplane mechanics as safety agents and as airways flight inspectors. The CAA also operates the Federal Airways System, a network of designated lanes through the air space along which aircraft are guided from airport to airport by an elaborate system of radio and radar controls. The Federal Airways System employs airway operation specialists who provide information and guide planes using the airlanes. The CAA personnel are Federal employees whose major function is to serve the civilian air transportation industry. In mid-1956, the CAA employed about 15,000 workers.

In addition to the personnel employed by the airlines and by the Federal Government, thousands of other workers are employed in the field of commercial aviation. Most of these workers are employed by independent aircraft and engine repair firms and by "fixed base operators," which run flying schools, do aerial photography, advertising (sky writing), and agricultural work such as dusting, spraying, and seeding. Some pilots also work for oil companies, patrolling oil pipelines and assisting in exploration. Many other flying and maintenance personnel work for companies which operate their own airplanes to transport their executives.

Occupations in Air Transportation

The transportation of passengers and cargo by air requires a great many skilled workers to fly the planes, maintain and repair the equipment, provide services to passengers at terminals and during flight, and perform ordinary business services. Flight personnel made up about 18 per-

cent of scheduled airline employment in mid-1956. More than 30 percent of the airlines' workers were mechanics and other maintenance and repair personnel. Persons who work at airline ground stations communicating with aircraft in flight comprised about 5 percent of the industry's workers. The remaining airline personnel worked at the terminals and company offices selling tickets, making reservations, checking and loading baggage, and performing clerical and administrative work.

Flight crews consist of pilots, copilots, and flight engineers who operate the aircraft; and stewardesses who perform various services for the passengers. All commercial airline flights have a captain and a copilot. Many domestic and most international flights also have a flight engineer on board to see that the engines, gages, and controls operate satisfactorily and to take proper emergency measures in flight. Navigators and flight radio operators are sometimes carried on international flights to aid the pilot in navigating and maintaining communications. All passenger planes carry stewardesses; a few have stewards.

Ground operational personnel consists of dispatchers, controllers, meteorologists, and radio operators who assist flight crews by communicating with them from bases on the ground. Dispatchers guide and give other information to all planes operated by their company flying within a given radius of their airport. Air-route and airport traffic controllers employed by the CAA operate the Federal Airways System. They give landing and takeoff directions and navigational aid to all planes flying in their airlanes. Meteorologists interpret and analyze weather information and report their findings to dispatchers to assist them in making decisions on flight operations. Radio operators and teletypists assist both dispatchers and controllers, making direct connections with the planes and relaying messages to flight crews and to other airports.

Mechanics see that planes are in good condition before each flight, do emergency repair jobs, and overhaul and recondition aircraft and engines at periodic intervals. Stock and store clerks receive, store, issue and keep records of the thousands of parts and supplies kept at aircraft maintenance bases.

A detailed description of the duties, training, and other qualifications; employment outlook; and earnings and working conditions for each of the following air transportation jobs appears in the later sections of this chapter: Pilots and copilots, flight engineers, stewardesses, airplane mechanics, dispatchers and assistants, airport and air-route traffic controllers, ground radio operators and teletypists, and traffic agents and reservation clerks.

Employment Outlook

A continued rapid rise in employment in the air transportation industry is expected in the late 1950's and the 1960's. Employment in this industry is expected to grow at a faster rate than the Nation's labor force as a whole during this period. Most of the increase in employment will be in the scheduled airlines.

Airline traffic and employment have grown rapidly during most of the industry's brief history. In 1934, when the industry was about 8 years old, the scheduled airlines flew less than 190 million domestic revenue passenger miles. Six years later, in 1940, the number exceeded 1 billion. By 1945, scheduled airlines flew more than 3 billion domestic passenger miles. In 1955, scheduled airlines flew about 20 billion domestic revenue passenger miles; this was 2½ times that flown in 1950 and almost 6 times that flown in 1945. Shown below are the domestic revenue passenger miles (in thousands) flown by scheduled airlines:

1934	189, 806
1940	1, 052, 156
1945	3, 362, 455
1950	8, 002, 825
1951	10, 566, 182
1952	12, 528, 318
1953	14, 760, 309
1954	16, 768, 706
1955	19, 819, 221

Cargo carried by aircraft has also increased rapidly in recent years. The number of express and freight ton miles flown in 1955 was more than 3½ times that of 1947.

Employment in the scheduled airlines has increased along with the expansion of passenger traffic. Most of this growth has been in domestic operations. In 1934, about 4,000 workers were employed in domestic scheduled airline operations. By 1940, employment reached nearly 16,000, and by 1945 the scheduled airlines employed more than 50,000 workers. After some sharp fluctuations in the immediate postwar period, employment has grown steadily; by 1956 more than 100,000 workers were employed in domestic operations. The num-

ber of workers in scheduled international air carrier operations has increased steadily, reaching 28,000 in 1956. Employment in the nonscheduled airlines and in other fields of commercial aviation has also increased somewhat in the past 5 years. By mid-1956, more than 150,000 workers were employed in the air transportation industry.

A continuation in the growth of air travel is expected during the late 1950's and the 1960's. Increased consumer purchasing power, the trend toward longer vacations, the greater dependence upon air travel by businessmen, faster flights at rates competitive with rail and bus transportation, and the introduction of air coach service in medium- and short-distance flights are among the factors which will result in greatly increased air travel. The airlines in 1956 had already acquired the major share of the Nation's long distance common carrier travel (over 1,000 miles) and it is believed they will obtain an even larger share in the future. However, the largest expansion is expected in the medium- and short-distance (from 100 to 1,000 miles) travel market. Low-cost air coach service, which has greatly increased long distance air traffic, has not been offered on many medium- and short-distance flights. When this service is introduced, it is expected to bring about a great expansion in airline traffic.

Forecasts made by the CAA in mid-1956 estimated that the number of domestic revenue passenger miles flown by the scheduled airlines in 1965 will be 208 percent higher than the figure for 1955. The same CAA forecast showed international traffic increasing about 173 percent from 1955 to 1965. Considerable expansion in air cargo shipment is also anticipated in the late 1950's and the 1960's. Continued growth in the activities of nonscheduled airlines as well as in agricultural, patrol, and survey aviation services is expected during this same period.

Air transportation employment is not expected to increase at as fast a rate as traffic. This has been the industry's experience in recent years. For example, between 1950 and 1955, domestic air revenue passenger miles flown by scheduled airlines increased by about 150 percent, whereas employment in domestic scheduled airlines increased by about 50 percent. Faster, bigger, and more efficient planes will make it possible to carry more passengers per airline employee in the future. Expanded air coach service will also bring about increased productivity in this industry. Electronic computing and accounting machines, now being introduced, will enable the airlines to handle a much greater volume of reservations, scheduling, and accounting operations without a comparable expansion in clerical employment. Nevertheless, a considerable growth in total airline employment is anticipated.

Earnings and Working Conditions

Pay rates vary greatly both among and within occupations depending on degree of skill, length of experience, amount of responsibility for safe and efficient operations, and many other factors. The statements on individual aviation occupations which follow contain detailed discussions of earnings and working conditions for each occupation. In addition to their earnings, airline employees often receive free air travel benefits.

Air transportation is a round-the-clock industry with flights scheduled for all hours of the day and night. Flight personnel and workers who prepare for and aid flights, therefore, may have an irregular pattern of working hours which often includes night, weekend, and holiday work. To compensate for the irregular hours, airline employees get rest periods on long workdays, and receive premium rates for overtime, holidays, and nightwork. Maximum hours of work per month for flight personnel have been established by the CAB as a safety precaution against fatigue. On the other hand, union agreements often stipulate that persons in flight occupations be paid for a minimum number of hours per month in order to guarantee a specified level of earnings. Most maintenance, sales, and administrative workers in the industry work the usual 5-day, 40-hour week. Many of the workers in air transportation are union members. These unions are mentioned in the sections covering the individual jobs.

Where To Go for More Information

To find out about openings in a specific airline and the special qualifications required, one should write to the personnel manager of the line. Addresses may be obtained from the Air Transport Association of America, 1107 Sixteenth St., NW., Washington 6, D. C.

Inquiries regarding jobs with the Civil Aeronautics Administration should be addressed to the

Regional Administrator, Civil Aeronautics Administration, at any of the following addresses:

Region 1. Federal Building, New York International Airport, Jamaica, Long Island, N. Y.
Region 2. 84 Marietta St., NW., Atlanta, Ga.
Region 3. Chicago Orchard Airport, Park Ridge, Ill.
Region 4. P. O. Box 1689, Fort Worth, Tex.
Region 5. City Hall Building, Kansas City, Mo.
Region 6. 5651 W. Manchester Boulevard, Los Angeles 45, Calif.
Region 7. P. O. Box 3224, Seattle, Wash.
Region 8. P. O. Box 440, Anchorage, Alaska.
Region 9. P. O. Box 4009, Honolulu 12, T. H.

Information on CAA-approved schools offering training for work as an aviation mechanic or pilot and in other technical fields related to aviation may be obtained from:

Aviation Education Division W–150, Office of Aviation Development, Civil Aeronautics Administration, Washington 25, D. C.

Pilots and Copilots

(D. O. T. 0–41.10 and .12)

Nature of Work

Pilots operate the controls of the plane and perform many other flight tasks. They operate the radio, navigate for the flight, and keep close watch on the many instruments which indicate the condition of the engines, fuel, controls, electronic equipment, and landing gear. In performing these duties, pilots apply their knowledge of meteorology, methods of navigation, and flight procedures.

All scheduled airline flights carry a captain and a copilot. The captain has complete responsibility for the aircraft and its passengers and cargo. He is commander of the flight crew, which may include a flight engineer, navigator, or, in a few cases, a flight radio operator. The copilot is second in command during the flight, and often operates the controls of the plane.

Both captain and copilot also have extensive ground duties. Before each flight they confer with the company meteorologist about weather conditions and prepare a flight plan in cooperation with the airline dispatcher. They make a preflight check on the condition and loading of the aircraft and the functioning of the engines and instruments. If the weather is bad, the captain must decide whether to make the flight. When the flight is completed, the captain makes a report for the company's records.

Pilots employed by the large nonscheduled airline companies generally perform the same duties as those employed by the scheduled airlines. However, pilots employed by the small irregular airline companies, whose service is sometimes called air taxi service, fly smaller, less complex planes. They seldom have copilots or assisting crews and they make flights without the assistance of meteorologists or dispatchers. Sometimes these pilots must supervise or perform the maintenance work on their planes.

In flying a business concern's private plane, the pilot sees that the plane is ready, makes flight plans, and transports company officials wherever they wish to go. Pilots who operate their own local air transport companies often have business and managerial functions similar to those of other small businessmen.

In addition to the pilots engaged exclusively in flight work, there are also pilots who make inspections and do other kinds of work. The airlines employ "check pilots" who make flights at least twice a year with each captain to observe his efficiency and to insure that he is flying in conformance with airline and CAA regulations. Pilots on the staff of the CAA are engaged almost entirely in inspection work. "Patrol pilots" patrol and inspect the air-navigation facilities of the Federal airways. "Aeronautical inspectors" examine applicants for pilot and other airman certificates; inspect civil aircraft, flying schools, and repair stations; and investigate accidents to aircraft other than airline planes. "Air carrier inspectors" examine airline personnel and investigate airline accidents. The few CAA pilots who are not inspectors do flight testing of equipment at experimental stations.

The scheduled airlines employed more than 9,000 pilots and copilots in domestic operations and more than 2,000 in international operations in 1956. Several hundred pilots were employed by nonscheduled airlines. In addition, a considerable number of pilots were employed in business, agricultural, instructional, and other types of flying.

Copilot, flight engineer, and captain at controls of a large airliner.

Training, Other Qualifications, and Advancement

To do any type of flying, a pilot must have a certification or rating from the CAB. The CAB has set up requirements for pilots concerning technical competence, flight experience, and physical condition depending on the type of plane and type of flying performed.

All persons who fly must have at least a private pilot's license. A commercial license is required for any flying that involves transportation of persons or property for pay. A special rating is given for airline transport pilots and is required of all captains of scheduled airlines. All airline captains and copilots must also have a rating for instrument flying. In addition, separate ratings are established for all pilots on the basis of the type of plane flown—single-engine, multi-engine, land, or seaplane.

To secure a CAB pilot rating, an applicant must pass a physical examination and a written test; submit proof of the required amount of flying time, which ranges from 200 hours for a commercial license to 1,200 hours for an airline transport pilot (captain) rating; and demonstrate flying skill.

A young man may obtain the training, knowledge, and flight experience necessary to become a pilot either through training and experience in the Armed Forces or by attending an accredited civilian flying school. Additional training is sometimes provided by airlines to newly hired pilots. Those trained in the Armed Forces have a good opportunity to log hours on multiengined aircraft similar to those used by commercial airlines. A graduate of a certified flying school can meet the aeronautical experience requirements for CAB licensing by presenting a certificate of grad-

uation within 60 days after graduation. The appropriate military flying experience is accepted in place of the written and practical test of flight knowledge and skill. The certificates issued by the CAB remain in effect until surrendered, suspended, revoked, or otherwise terminated by order of the Board. However, a physical examination is required each year to keep the certification current.

Men hired by the scheduled airlines, and by some of the larger nonscheduled airlines as well, usually start as copilots. In a few airlines, they begin as flight engineers and a commercial pilot's license is required. An applicant for a copilot's job with a scheduled airline must have other qualifications in addition to his commercial pilot's license. Although a man can qualify for the license with only 200 hours of flying time, the airlines generally require from 500 to 1,000 hours. Men between the ages of 21 and 30 are preferred. However, both the flying time and the age requirements may be relaxed when qualified applicants are scarce. In 1956, when pilots were in great demand, some airlines raised the age limit to 35 and lowered the flying requirement to 200 hours. A high school education is required, but preference is given men with 2 to 4 years of college. Most airlines require that pilots be between 5 feet 7 inches and 6 feet 4 inches tall. All airline pilots must pass a physical examination twice a year.

Airline companies usually give new copilots from 3 to 10 weeks' training on company planes before assigning them to a scheduled flight. The new copilot is generally permitted only limited responsibility, such as flying the plane in good weather over safe terrain. His responsibilities are gradually increased as he gains experience and skill. When the copilot has proved his ability and has accumulated sufficient seniority he may advance to the position of captain as openings arise. However, this usually takes at least 2 years and often much longer.

There are some possibilities for pilots with outstanding administrative ability to advance to positions as chief pilot, assistant superintendent of flight operations, and other higher executive jobs. However, most captains spend their entire careers in this job, where their increasing seniority gives them a better selection of flight routes and higher earnings.

Employment Outlook

A substantial increase in the number of pilots in the air transportation industry is expected in the late 1950's and the 1960's. The anticipated large increase in the volume of traffic on scheduled airlines will create most of the job openings in this relatively small occupation. The number of pilots employed by the nonscheduled airlines and air cargo lines is also expected to increase. The need to replace experienced pilots who retire, die, or transfer to other fields of work will also create a small number of job openings each year.

There has been a rapid increase in the number of pilots employed in the air transportation industry in the post-World War II period. The number of pilots and copilots doubled from the end of World War II to mid-1956. The anticipated large increase in the volume of air traffic in established routes and the establishment of new routes indicate a growing demand for pilots. The CAA has forecast a 208 percent increase in the number of domestic revenue passenger miles to be flown by scheduled airlines between 1955 and 1965 and a 173 percent increase in international traffic. However, the number of pilots will not grow nearly as fast as the increased volume of air traffic. The introduction of larger and faster planes will result in increased passenger miles per pilot employed.

In mid-1956, a shortage of well-qualified applicants for copilot jobs was developing. Since the end of Korean hostilities, the number of trained pilots leaving the Armed Forces has declined considerably. Fewer pilots were being trained by the peacetime military services and many of them were making military flying their lifetime career. In addition, many of those leaving the service were not taking flying jobs.

Another reason why the airlines are finding it increasingly difficult to recruit pilots is that other civil aviation activities are growing and attracting applicants. Business flying has been growing rapidly since 1946, and agricultural, patrol, and other types of flying have also increased. Since these piloting jobs do not require such long preparation and do not have as rigid requirements as airline jobs, they are preferred by some persons who do not want to take the time to qualify for airline work or cannot afford the cost of training.

Earnings and Working Conditions

This is one of the Nation's highest paid occupational fields. The average annual earnings of pilots and copilots on domestic scheduled airlines was about $12,000 in 1956 and between $13,000 and $14,000 on international operations. Earnings of pilots have a considerable range depending on such factors as flying time, mileage, size and speed of the planes they fly, and length of service. Many experienced captains on international operations earned more than $20,000 in 1956. Pilots employed by scheduled airlines generally received much higher earnings than those employed elsewhere.

Copilots earn considerably less than captains. In 1956, most beginning copilots received a starting salary between $350 and $450 a month. Salary increases are given to copilots as they gain experience. Some copilots with more than 5 years of experience were earning as much as $950 a month.

Airline pilots averaged between 70 and 80 hours flying time a month in 1956. Under CAA rules, they may not fly more than 85 hours a month, 255 a quarter, and 1,000 a year. Ground duties require many additional hours of work each month.

Airline pilots in domestic operations generally receive a 2 weeks' vacation with pay; those with from 10 to 15 years of service often receive 3 weeks'. In international operations some pilots receive 1 month's annual vacation.

Many airline pilots are on duty away from their base about a third or more of the time. When they are away from home, their living expenses are usually paid by the airline.

Most airline pilots are members of the International Air Line Pilots Association. Unionization among other pilots is rare.

Flight Engineers

(D. O. T. 5–80.100)

Nature of Work

Flight engineers assist the captain and copilot on the larger commercial airplanes. They are responsible for the proper functioning of the aircraft (and engines) in flight, permitting the captain and copilot to concentrate more fully on piloting the aircraft. The new airplanes put into service since World War II have generally been larger and more complex, placing a greater burden on the captain and copilot. As a result, an increasing number of flight engineers are being employed in domestic and international operations. By the end of 1956, the scheduled airlines had more than 2,500 flight engineers on their payrolls.

In the air, the duties of the flight engineers include watching and keeping logs on engine performance and fuel consumption, and operating certain controls under the direction of the captain. At stops where there are no mechanics, they may perform ground maintenance work themselves and make preflight checks on the airplane, engines, and instruments.

Civil Aeronautics Board regulations require that a flight engineer be carried on all 4-engine planes which have a maximum takeoff weight of more than 80,000 pounds and on certain types of smaller aircraft. Such planes constituted about one-third of the airline fleet in 1956. Almost all of these aircraft are operated by the scheduled airlines. International operators fly a much higher proportion of these planes than do domestic operators. Most flight engineers are stationed in or near large cities where long distance flights originate or terminate.

Training, Other Qualifications, and Advancement

Every person serving as flight engineer is legally required to have a CAA Flight Engineer Certificate. A man can qualify for a flight engineer certificate if he has had from 2 to 3 years of training or work experience in the maintenance, repair, and overhaul of aircraft and aircraft engines, including a minimum of 6 months to a year of working on large 4-engine equipment. He may also qualify with at least 200 hours of flight time as a pilot in command of a 4-engine plane or 100 hours of experience as a flight engineer in the Armed Forces. A third method of qualifying is to complete a course of ground and flight instruction which the CAB considers adequate for the training of flight engineers. In 1956, a few of the airlines conducted such courses for their prospective flight engineers.

In addition to the experience or training qualifications mentioned above, the applicant for a flight engineer certificate must pass a written test on flight theory, engine and aircraft performance, aircraft loading, and maintenance precedures. He must also meet certain physical requirements, and demonstrate in a practical test that he can perform the duties of a flight engineer.

Young men interested in becoming flight engineers can obtain the necessary training and experience in several ways. They may attend a civilian school that trains mechanics. They could then obtain jobs as airframe and powerplant (A and P) mechanics. In those airlines which use mechanic-type flight engineers, a 5–6 months' course of additional training given by the airline will qualify A and P mechanics as flight engineers. Young men can also acquire the knowledge and skill necessary for qualifying as a flight engineer by receiving training as a mechanic, copilot, or flight engineer while in the Armed Forces.

In hiring new workers for jobs as flight engineers, airline companies generally prefer men who are from 23 to 35 years of age, from 5 feet 7 inches to 6 feet 4 inches in height, and in excellent physical condition. A high school education is required, and men with 2 or more years of college are preferred. Most airlines require that applicants have an active CAA A and P mechanics license and an FCC restricted radiotelephone license.

Although the majority of airlines employ flight engineers who were originally trained as mechanics, some lines hire qualified pilots for these jobs. These airlines have requirements for flight engineers which are very familiar to those for copilots. A few airlines use the flight engineer job as the beginning job for pilots and require them to have a commercial pilot's license. In these airlines flight engineers can be promoted to copilots and then to jobs as pilots.

Employment Outlook

Employment of flight engineers will increase rapidly during the late 1950's and the 1960's as the scheduled airlines expand their facilities to meet the greatly increased demand for air transportation. Most of the new planes put into service will be large 4-engine planes requiring a flight engineer in the flight crew. Although the number of flight engineers will probably double over the next decade, this will still be a small field of work, open only to experienced mechanics or pilots.

In the decade since World War II, the scheduled airlines increased their employment of flight engineers as newer and larger planes were gradually put into service. Jobs as flight engineers were rather difficult to obtain during most of this period because of the large supply of trained men who were being released from the Armed Forces. By 1956, this situation had radically changed. The number of trained flight engineers, copilots, and mechanics coming out of the service was declining at the same time that the airlines were beginning a large-scale expansion. As a result, qualified applicants for flight engineering jobs were in demand. The expected continued growth of employment in this small field and the anticipated short supply of mechanics and pilots—the 2 groups from which most flight engineers are recruited—should result in relatively good opportunities for qualified persons to obtain jobs as flight engineers in the late 1950's and the early 1960's.

Earnings and Working Conditions

In 1956, earnings of qualified flight engineers ranged from about $500 to $800 a month, depending mainly on length of experience and amount of time flown. A few flight engineers earned more than $1,000 a month. Flight time is usually restricted to a maximum of 85 hours a month in domestic flying or 255 hours a quarter in international flying. Additional time is spent in ground duties. Flight engineers in international operations usually receive a month's paid vacation each year, whereas those flying domestic routes get only 2 weeks.

Most flight engineers are on duty away from their home base about a third or more of the time, during which time the companies usually pay their living expenses. The major union organizing flight engineers in 1956 was the Flight Engineers' International Association. In a few airlines, these workers are represented by the International Association of Machinists.

Stewardesses

(D. O. T. 2–25.37)

Nature of Work

Stewardesses (sometimes called hostesses) are carried on all commercial airline passenger flights to attend to the comfort of the passengers from the time they board the plane until they arrive at their destination. Before the plane takes off the stewardess sits in on the briefing of the flight crew. As the passengers board, she checks tickets and sees that all passengers are seated comfortably. During the flight, she gives instructions to passengers and makes certain that seat belts are fastened when safety measures require it. She answers questions about flights and weather, gives aid to passengers when necessary, and helps care for small children. On first-class flights, the stewardess heats and serves ready-cooked meals. On coach and tourist flights, she serves light refreshments. Stewardesses on international flights have additional duties; they make up berths, and give instructions and information in several languages to accommodate the foreign passengers.

In 1956, more than 6,000 stewardesses were employed in domestic operations, and over 1,500 were in international operations. Most flights carry 1, 2, or 3 stewardesses, depending on the size of the plane and whether it is tourist or first class. Most stewardesses are stationed in the larger cities on the airlines' main routes. A few of the stewardesses in international operations are based in foreign countries.

Stewardess checking in passengers prior to flight.

Training, Other Qualifications, and Advancement

Because stewardesses are in constant contact with passengers, the airlines place great stress on hiring young women who are attractive, poised, pleasant, and resourceful. Generally, they require that girls be from 20 to 28 years of age, 5 feet 2 inches to 5 feet 8 inches in height, well-proportioned, and in excellent health. All the large airlines require that stewardesses be unmarried (single, widowed, or divorced) and usually require that they resign when they marry or shortly thereafter. Applicants for stewardess jobs must have at least a high school education, and young women with 1 or 2 years of college, nurses' training, or business experience in dealing with the public are preferred. Airlines that are solely international carriers generally require that their stewardesses be able to speak a foreign language fluently.

Most of the large airlines train newly hired stewardesses for 4 to 6 weeks in their own schools. Training includes instruction in work duties, company procedures, weather and flight information, first aid, and grooming. In the later phases of training, the girls go on practice flights to learn how to perform their duties under actual flying conditions. A few airlines which do not operate their own schools recruit stewardesses from graduating classes of special private stewardess schools. Girls who attend these schools must pay their own expenses. Experienced stewardesses may be advanced to jobs as stewardess supervisor, stewardess instructor, or stewardess employment representative.

Employment Outlook

Employment of stewardesses will increase considerably during the late 1950's and the 1960's as the scheduled airlines expand their operations to

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meet the greatly increased demand for air travel. However, the great majority of the openings for stewardesses will result from girls leaving the occupation to get married or for other reasons. This occupation has an extremely high turnover rate. In recent years, between 35 and 50 percent of stewardesses have left their jobs each year. Although there will be many job openings in the late 1950's and the 1960's, competition for jobs will be keen.

Earnings and Working Conditions

Monthly base pay for new stewardesses in mid-1956 ranged from $200 to $255. In some companies, supplementary pay based on hours of flight brought the starting salary of stewardesses up to as much as $280 a month. Top base pay of experienced stewardesses ranged from $280 to $350 a month. Supplemental payments brought earnings for some stewardesses to more than $400 a month. Stewardesses on overseas routes usually receive higher salaries than those on domestic routes. The companies which train their own stewardesses usually pay them a training salary or living expenses during the training period.

Since the commercial airlines operate around the clock, stewardesses' hours of work often include night and weekend work. As a result of irregular schedules and limitations on the amount of flying time, the total worktime of stewardesses averages considerably less than 40 hours a week, and they may have from 8 to 15 days off each month. Most companies limit stewardesses' flight time to 85 hours a month. In some airlines supplemental pay rates begin after the first 65, 70, or 75 hours. In addition to flying time, stewardesses devote from 10 to 20 hours a month to ground duties. Approximately a third of a stewardess' time is spent away from home base; on these occasions, the airlines usually pay for her meals and lodgings.

Most companies use the bidding system for assigning bases and flight schedules; the stewardesses with greatest seniority get first choice. Other companies rotate assignments among all their stewardesses.

Domestic airline companies generally give 2 weeks' vacation with pay; some international lines give 4 weeks. Most companies give discounts for travel on their own flights and have reciprocal agreements with other airlines giving their employees discounts.

Many stewardesses belong to unions. In most of the large airlines, stewardesses are represented by the International Air Line Stewards and Stewardesses Association. Stewardesses employed by a few airlines are members of the Air Transport Division of the Transport Workers Union of America.

Airplane Mechanics

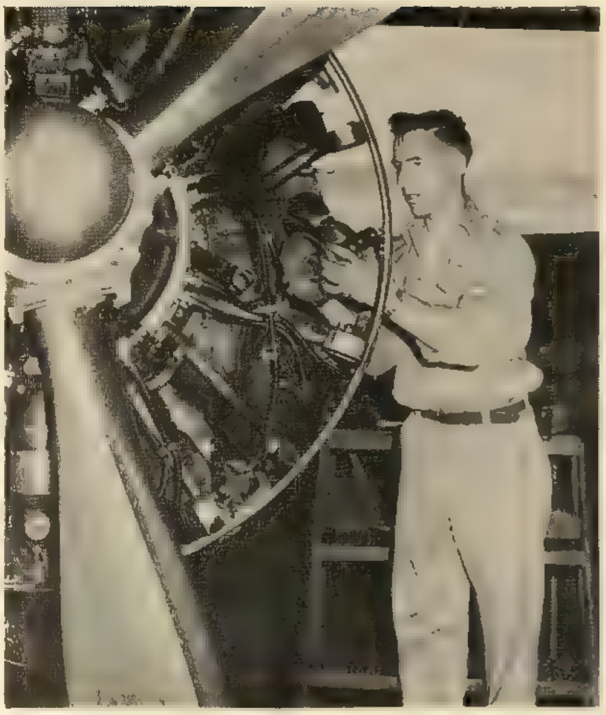
(D. O. T. 5–80.120 and .130)

Nature of Work

Airplane mechanics service, overhaul, inspect, and certify to the airworthiness of airplanes. Mechanics employed by the airlines are assigned either to line-maintenance or to overhaul work. Line-maintenance mechanics work at the larger airline terminals servicing and inspecting aircraft and making minor repairs and adjustments. When an engine or other piece of equipment is due to be overhauled, these mechanics remove it from the plane and install new or overhauled equipment in its place. Line-maintenance shops usually have small staffs; most line-maintenance mechanics must therefore be all-round A and P (airframe and powerplant) mechanics legally qualified to repair aircraft and certify to the airworthiness of the planes after the repairs are made.

Mechanics employed at the airline's main overhaul base make major repairs and do periodic overhaul work on engines and airframes. Since most aircraft maintenance at these bases consists of replacing and reconditioning equipment at fixed intervals rather than repairing equipment that has broken down in service, the operations can be scheduled in advance and work assignments vary little from day to day. With this organization of work, it is feasible to employ mechanics who usually specialize in a particular part of the airplane, such as engines, propellers, hydraulics, electrical equipment, radio and radar, instruments, and sheet metal. The proportion of all-round A and P mechanics at the main overhaul bases is considerably lower than at other airline terminals.

Most airplane mechanics not employed by the airlines do servicing and inspection work roughly



Airplane mechanics must have a CAA license to make engine repairs.

comparable with that performed by line-maintenance mechanics. However, the planes which these mechanics service are often much smaller than airliners; many of them have only a few instruments, no radio, and a simple, fixed-pitch propeller. One mechanic frequently must do the entire servicing job with little supervision, and he must be able to work on many types of planes and engines. Mechanics employed by some of the large flying services, flying schools, and independent repair shops may also do overhaul work. Independent shops usually specialize in either airframe, engine, or instrument overhaul.

In 1956, more than 30,000 mechanics were employed by the scheduled airlines. Many other mechanics were employed by fixed base operators and independent aircraft and engine repair firms. The Armed Forces also employed a great many civilian mechanics as well as military personnel to maintain military aircraft.

Many airplane mechanics work in aircraft manufacturing plants. These workers, whose duties are somewhat different from those of airline mechanics, are discussed in detail in the chapter on Aircraft Manufacturing Occupations. (See index for page numbers.)

The CAA also employs qualified airplane mechanics in a variety of positions. For example, "air carrier maintenance inspectors" make periodic inspections of the aircraft, maintenance personnel, and facilities of the scheduled airlines, independent repair shops, and mechanics' schools. The CAA also employs mechanics who inspect factories and a few who maintain CAA's own aircraft.

Most airline mechanics are employed in the larger cities on the main airline routes. Each airline usually has one main overhaul base where more than half of its mechanics are employed. Cities such as New York, Chicago, Los Angeles, San Francisco, and Miami, all of which are important domestic and international air traffic centers, have large concentrations of mechanics.

Training, Other Qualifications, and Advancement

Because the safety of aircraft in flight depends largely on good mechanical operation, mechanics who make and certify repairs on aircraft are required by law to have a CAA license. Applicants for line-maintenance jobs and for most of the skilled jobs at overhaul bases and repair shops are required to have a CAA license authorizing them to work on either airframes (A), powerplants (P), or both (A and P).

To obtain a CAA license for either airframe or powerplant work, a man must have at least 18 months of experience in the construction, inspection, maintenance, and repair of airframes or powerplants; for a combined rating (A and P), he must have at least 30 months' concurrent experience in both types of work. This experience is not required of a man who graduates from a certificated mechanics' school providing he applies for the license within 60 days after his graduation. In addition to meeting these experience and training requirements, an applicant must also pass a written test and give a practical demonstration of the required mechanical skills. The airframe and powerplant certificates do not authorize a mechanic to repair instruments or propellers. Mechanics who do such work must have an additional repairman certificate. Some mechanics who repair radio and radar equipment are required to have an FCC radiotelephone license.

To qualify as a skilled mechanic with an airline, a man must have 3 or 4 years of training and ex-

perience in maintaining aircraft. Because experienced men are not always available, the larger airlines sometimes hire new men as apprentices or trainees and give them thorough training in a carefully planned 3- or 4-year program of instruction and work experience. They also hire men who have graduated from a mechanics school approved by the CAA. Most of these schools have an 18- to 24-month course.

Men who have learned aircraft maintenance in the Armed Forces are usually given credit for this training toward the requirements of apprenticeship or other on-the-job training programs. Those that have already obtained CAA licenses, may be able to start in as journeymen mechanics.

For apprentice or trainee jobs, the airlines prefer men between the ages of 20 and 30 who are in good physical condition. Applicants should have a high school or trade school education, including courses in mathematics, physics, chemistry, and machine shop. Experience in automotive repair or other mechanical work is helpful in obtaining an entry job. Apprentices are often required to own a considerable number of handtools, which they must pay for themselves. Some airplane mechanics have learned this trade by working as helpers to experienced mechanics and thus acquiring enough knowledge and skill to pass the CAA examinations to become licensed mechanics.

Journeymen mechanics in the scheduled airlines may advance to a number of higher positions. Within the maintenance department, the line of advancement is usually mechanic, inspector, lead mechanic, crew chief, shop foreman, lead inspector, and, in a few cases, supervisory and executive positions. In most shops, mechanics in the higher grade positions are required to have both airframe and powerplant ratings.

Since World War II, the increased use of flight engineers has opened a new field of advancement for highly skilled airplane mechanics. The majority of the scheduled airlines fill openings for flight engineers by giving their best mechanics additional training and promoting them to these higher paying positions in the flight crews.

For jobs as aircraft inspectors for the CAA, mechanics must have at least 5 years of broad and varied experience in airframe and powerplant maintenance and overhaul work. Ten years of such experience is required for air carrier maintenance inspectors. Applicants for these jobs should also have held A and P licenses for at least 5 years.

Employment Outlook

Airplane mechanics will be employed in increasing numbers during the late 1950's and the 1960's as a result of the expected large expansion of air transportation services. (See general introduction to this chapter.) The scheduled airlines will hire thousands of additional mechanics during this period to maintain the larger fleets of planes required to handle anticipated increases in traffic. In addition, the continued rapid growth in the amount of business flying and a moderate expansion of other flying services will also significantly increase employment of airplane mechanics. Many openings will also occur as a result of deaths, retirements, and transfers of mechanics to other fields of work.

The number of mechanics employed by the scheduled airlines (on both domestic and international operations) increased from less than 6,000 in 1940 to more than 30,000 at the end of 1956 as airline traffic expanded. Much of this increase took place since World War II.

Increased activity in general aviation flying in the post-World War II period has also greatly increased the need for airplane mechanics. Hundreds of additional aircraft have been put into service for business flying in the last few years, and other types of general aviation flying have also grown.

Many of the mechanics employed by the airlines, as well as those employed in general aviation activities, are veterans of World War II or the Korean hostilities who were trained as aircraft mechanics in the Armed Forces. The number of experienced airplane mechanics leaving the Armed Services and taking jobs with the scheduled airlines declined in the mid-1950's at the same time the needs of the airlines and other employers were increasing. By mid-1956, skilled mechanics were in relatively short supply.

Earnings and Working Conditions

The average annual earnings of mechanics employed by domestic scheduled airlines was $5,341 in 1955. Mechanics not employed by the sched-

uled airlines generally have lower average earnings. However, they have a wider range of earnings.

Airline mechanics usually work a 40-hour week. However, since airline maintenance facilities must be available at all hours of the day and night, work schedules of mechanics include night shifts and weekend work. Shifts are usually rotated among the individual mechanics. Premium rates are usually paid to mechanics on night shifts.

Airline mechanics receive paid vacations and many other benefits such as pensions and insurance. Like other Federal personnel, CAA employees receive 13 days of annual leave at the start, 20 days after 3 years of service, and 26 days after 15 years.

Mechanics are covered by union agreements on most major airlines. Most of these employees are members of the International Association of Machinists. The Air Transport Division of the Transport Workers Union of America also organizes airplane mechanics.

Traffic Agents and Clerks

(D. O. T. 1–44.12, .27, and .32)

Nature of Work

Traffic agents and clerks perform the many tasks required in handling passenger and freight traffic. In mid-1956, more than 20,000 persons were employed as air traffic agents and clerks in such jobs as ticket agents, operations agents, freight agents, reservation agents, cargo clerks, and traffic representatives.

Ticket agents issue tickets to passengers as they check in for flights. They check baggage, answer inquiries about flight schedules and fares, and keep records of tickets sold. Reservation agents and clerks deal with customers by telephone, giving schedule information; recording, reporting, and posting reservations as they are made; and processing teletype messages regarding reservations. Traffic representatives try to promote the airlines' business by contacting potential customers in order to promote greater use of the airlines' services.

Operations agents are responsible for the ground handling of airplanes at their stations. They supervise the loading and unloading of the airplanes, and sometimes do this work themselves. They see that the weight carried by the planes is distributed properly, compute gas loads, prepare cargo and weight manifests, and keep records of the number of passengers and amounts of cargo carried. They may also fill out flight clearance and weather forms and make arrival and departure announcements.

Traffic staffs are located principally in downtown offices and at airports in or near large cities, where most airline passenger and cargo business originates. Some are employed in smaller communities where airlines have scheduled stops.

Training, Other Qualifications, and Advancement

Most traffic agents and clerks must deal directly with the public, either in person or by telephone. For this reason, airlines have strict hiring standards with respect to appearance, personality, and education. A good speaking voice is essential because of the frequent use of the telephone. High school graduation is almost always required; some college training is considered desirable. Courses in air transportation, offered by increasing numbers of colleges and universities, may improve one's chances for obtaining jobs and later advancement. These courses cover such topics as Government regulations, principles of rate-making, traffic anaylsis, and problems of aviation management. Experience in connection with freight or express traffic in other branches of transportation is also valuable. Aviation background and sales experience are helpful for higher grade jobs. Many women are employed as reservation and ticket agents.

Traffic agents may advance to positions as traffic representatives and supervisors. A few may eventually move up to city and district traffic and station manager.

Employment Outlook

Employment in traffic jobs will increase at a slower rate than overall airline employment during the late 1950's and the 1960's, despite the anticipated large expansion in airline traffic. An increasing volume of the routine tasks will be done by new electronic machines. By the end of 1956, many of the large airlines were already installing new machines to record and process reservations,

keep records, and perform a variety of other tasks. The job of the reservation clerks, in particular, will be affected by this mechanization. Improved equipment for handling baggage will also tend to reduce the requirements for workers doing these jobs. Ticket agents, whose main job involves personal contacts, will not be affected as much, although their paper work will be reduced considerably. On the other hand, the number of traffic representatives will probably grow more rapidly than overall airline employment as the airlines compete for new business.

Earnings and Working Conditions

Earnings of traffic agents in mid-1956 generally ranged from about $250 to $400 a month, depending primarily on the degree of responsibility of the particular job. Supervisory workers in this field were earning from $350 to $650 a month.

Traffic agents usually work a 5-day, 40-hour week. However, agents are often assigned to shifts which include evenings, nights, and weekends since airlines operate on a 24-hour basis. Traffic agents generally receive a 2 weeks' paid vacation each year.

Reservation and transportation agents are covered by union contracts on several lines. They are represented chiefly by the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employes. The Air Transport Division of the Transport Workers Union of America and the Air Lines Agents Association have also organized some of these workers.

Dispatchers and Assistants

(D. O. T. 0–61.61)

Nature of Work

Dispatchers are employed by airlines to control all their flights within an assigned area. The dispatcher's chief job is to coordinate plans for flight operations by working with the pilots and keeping them informed about weather and other flight conditions and to see that all CAA and company regulations are observed. Stationed at the terminals, they approve flight plans, authorize takeoffs, follow the progress of flights as reported by radio, and keep captains informed of changing weather conditions and other developments affecting their flights. Dispatchers see to it that crew members are notified when to report for duty, and that equipment and personnel do not fly beyond time limits specified by safety regulations. In smaller airlines they also keep records on the aircraft and engines available, on the amount of time logged by each plane and engine, and on the number of hours flown by flight personnel based at their station. Assistant dispatchers aid in this work, assuming such duties as securing weather information, helping to keep track of the progress of aircraft in the sector, and handling communications with the planes.

In 1956, only about 500 dispatchers and a thousand assistants were employed in domestic and international operations. Almost all dispatchers and assistants work for the scheduled airlines. A small number of dispatchers work for the larger nonscheduled lines and for private firms which supply dispatching service to small airlines. The majority of dispatchers and assistants are stationed at large airports in the United States; a few are stationed outside the country.

Training, Other Qualifications, and Advancement

Aircraft dispatchers are required to have a CAB aircraft dispatcher certificate. To qualify for certification, an applicant must have been engaged in work connected with dispatching of airline planes under supervision of a certified dispatcher for at least 90 days in the 6 months prior to certification. He must also qualify by graduating from a qualified CAA-approved dispatchers' school. He must pass a written examination on such subjects as Civil Air Regulations, aircraft characteristics, weather data and analysis, air-navigation facilities and principles, and airport and airway traffic procedures. He also has to demonstrate his skill in weather forecasting and certain other functions involved in dispatching.

Most airlines fill dispatcher positions by promotions or transfers from within the company. Men with long experience in ground operations work, who have had experience as assistant dispatchers or meteorologists, are preferred for these jobs. The knowledge and skill required for the job of dispatcher is generally learned while working as an assistant to an experienced dispatcher.

A few dispatcher's jobs are filled by experienced pilots no longer eligible to fly.

For assistant jobs, airlines generally hire applicants who have had 2 years of college. Men who have completed a 4-year college course—including training in mathematics, physics, chemistry, meteorology, and related subjects—are preferred. Experience as a pilot or a meteorologist, or a background in business administration is helpful.

Employment Outlook

The increase in airline traffic anticipated in the late 1950's and the 1960's is expected to result in a moderate increase in the number of workers employed in this small occupation. Most new workers will be hired as assistants. The bulk of the job openings for dispatchers will be filled by promoting or transferring persons already employed by the airlines.

Earnings and Working Conditions

In mid-1956, salaries for dispatchers generally ranged from about $500 to $900 a month. Assistant dispatchers earned from about $350 to $500 a month. The workweek is usually 40 hours, however daily work schedules are often set at 8½ hours. Two weeks' vacation with pay is usually given to both dispatchers and assistants; men with 10 to 15 years' service may receive 3 weeks' vacation. Most dispatchers are members of the Air Line Dispatchers Association.

Airport and Air-Route Traffic Controllers

(D. O. T. 0–61.60)

Nature of Work

Airport traffic controllers supervise all flights within a carefully defined flight-control area around an airport. They issue directions (by radio or other means) to all planes within the area, instructing pilots on takeoffs, landings, and flight levels. Other tasks include giving weather and position information to planes in the vicinity and keeping records of messages.

Senior controllers direct the entire traffic control staff and are directly responsible for all plane movements within the area. They also see to it that defects in airport lighting, communication, and other facilities are reported and that information regarding flights is regularly obtained from and relayed to air-route traffic-control centers in the vicinity. Assistant controllers, regarded as trainees for senior positions, aid them in carrying out these duties.

More than 2,500 airport traffic controllers were employed in the towers operated by CAA's Office of Federal Airways in 1956. A few hundred others worked in towers operated by airports. Both the CAA and the private airport towers are located at large airfields with heavy traffic, most of which are near big cities. A few are located outside the continental United States.

Air-route traffic controllers stationed at traffic-control centers regulate the movements of airplanes after they leave airport areas along the civil airways. The air-route traffic controllers usually do not communicate directly with planes but receive information on the progress of flights and related matters from airline dispatchers, airport traffic controllers, other air-route traffic controllers, and CAA communications stations. In return, they give instructions, advice, and information concerning conditions under which flights may begin or continue and report on the progress of flights under way. Telephone, interphone, teletype, and radio are used in transmitting these messages.

The Office of Federal Airways is the only employer of air-route controllers. More than 2,500 of these workers were employed at the various CAA traffic control centers scattered throughout the country.

Training, Other Qualifications, and Advancement

Generally, airport and air-route traffic controllers start as assistant controllers. To qualify for a position as a CAA assistant airport or air-route traffic controller, a person must pass competitive civil service examinations, which are given periodically. The applicant must have had 2 to 3 years of specified experience in one of several alternative fields, such as meteorology, aeronautical communications, dispatching, or flying.

Education above the high school level may be partially substituted for some of this experience.

Special CAA certificates requiring more extensive experience are necessary for airport jobs above the entry level. These certificates are good for work at a specific airport only.

Employment Outlook

Anticipated expansion of airline traffic in the late 1950's and the 1960's will result in greatly increased air traffic control activities. Larger and faster planes will require better control facilities to insure safety. As a result, employment of airport and air-route traffic controllers will increase considerably over this period. However, because of the small size of this occupation, the total number of openings in any one year will not be very large. Most new workers will be hired as assistants. In this occupation, like that of dispatcher, the applicant must compete not only with those trained specifically for this job but with ex-pilots, meteorologists, and other experienced airline personnel.

Earnings and Working Conditions

The starting salary for assistant airport and air-route controllers with CAA was $4,080 a year at the end of 1956. Senior controllers in both airport and air-route work had base salaries ranging from $6,390 to $8,990 a year, depending on the size of the unit they headed. In addition, within-grade increases are given every 12 or 18 months, depending on the grade. These employees receive the same annual leave, sick leave, and other benefits as other Federal workers.

CAA employees have a basic 40-hour week. However, air-route traffic controllers often have to work 4 or 5 hours' overtime in a week, which is compensated for by time off or premium pay. Since towers must be manned 24 hours a day, nightwork is required; employees are generally assigned to night shifts on a rotating basis.

Ground Radio Operators and Teletypists

(D. O. T. 0–61.33 and 1–37.33)

Nature of Work

Radio operators working for commercial airlines relay messages between ground stations and between flight and ground personnel, using radiotelephone or radiotelegraph. They occasionally make minor repairs on the equipment. Teletypists, who operate a machine with a keyboard similar to that of a typewriter, transmit airline ground communications. The CAA employs "aircraft communicators," who perform work similar to that described above for the Federal Airways System collecting and relaying information on weather conditions and other matters affecting flights. Some employees of both the airlines and the Civil Aeronautics Administration use both radio and teletype in their work.

In 1956, about 10,000 ground radio operators and teletypists were employed in air transportation. About two-thirds of these were employed by the scheduled airlines; the remainder worked for the Civil Aeronautics Administration or for some of the large nonscheduled carriers. The air branches of the Army and Navy employed a few hundred civilians as well as military personnel in similar jobs.

Teletype operator transmitting message between airline offices.

Ground radio operators and teletypists employed by the airlines work mostly at airports in or near large cities. CAA communicators work at stations, scattered along the major air routes, which are often located in remote places.

Training, Other Qualifications, and Advancement

Applicants for airline radio operator positions must usually have at least a third-class FCC radiotelephone or radiotelegraph license, a high school education, a good speaking voice, and be able to type at least 40 words a minute. Teletypists who work as radio operators must also have an FCC license.

To qualify for entry positions as CAA aircraft communicators, applicants must have had from 2 to 2½ years of experience in some phase of air communications, traffic control, or flying and they must meet the age and health requirements set by the United States Civil Service Commission. All permanent appointments are made on the basis of competitive civil service examinations which are given periodically.

The airlines commonly employ women as teletypists. An increasing number of women are also being hired as radio operators. Most CAA aircraft communicators are men.

Employment Outlook

Although air traffic is expected to rise considerably during the late 1950's and the 1960's, only a small increase in the employment of ground radio operators and teletypists is expected. An increasing amount of communication work will be handled by new electronic equipment which decreases the need for radiotelephone and teletype workers. A few hundred openings will arise each year as a result of deaths, retirements, and transfers to other fields of work.

Earnings and Working Conditions

Radio operators employed by the airlines generally were earning from about $300 to $400 a month in mid-1956. Earnings of teletypists ranged from about $250 to $350. CAA aircraft communicators received annual base salaries ranging from $3,670 to $5,915 in 1956. They receive within grade raises every 12 months.

Airline personnel usually gets 2 weeks' paid vacation; CAA employees receive the same annual and sick leave as other Federal workers. The basic workweek is 40 hours, both with the airlines and with CAA.

A number of lines have union agreements covering radio operators and teletypists. The major union in these fields in 1956 was the Airline Communications Employees Association (Ind.).

OCCUPATIONS IN THE ATOMIC ENERGY FIELD

The Atomic Energy Field and Its Workers

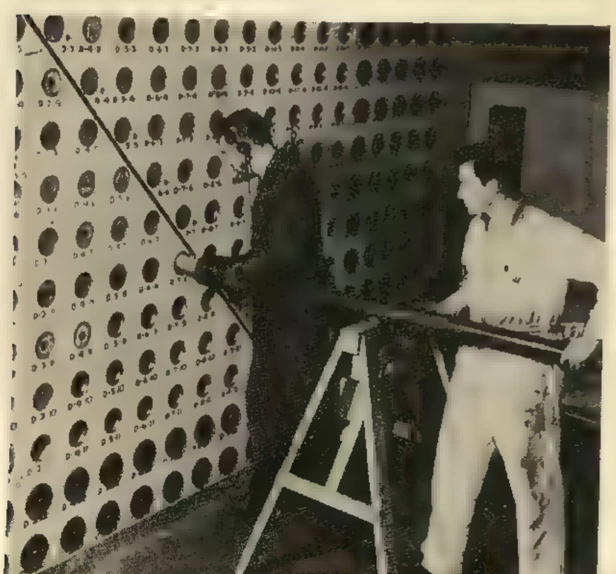
Atomic energy is a potential source of great power and a research tool of incalculable value. It has many applications in industry, medicine, and agriculture. The many activities related to the development and application of atomic energy have already made this an important field of employment opportunities.

By late 1956, more than 150,000 workers were employed in a variety of atomic energy activities. These workers included many highly trained persons—scientists, engineers, technicians, and craftsmen. A large proportion of these workers were employed in research and development activities. Others were engaged in mining, manufacturing, and construction work.

COURTESY OF U. S. ATOMIC ENERGY COMMISSION
Highly trained personnel operate the controls of an experimental nuclear reactor at Oak Ridge National Laboratory

How Atomic Energy Is Produced

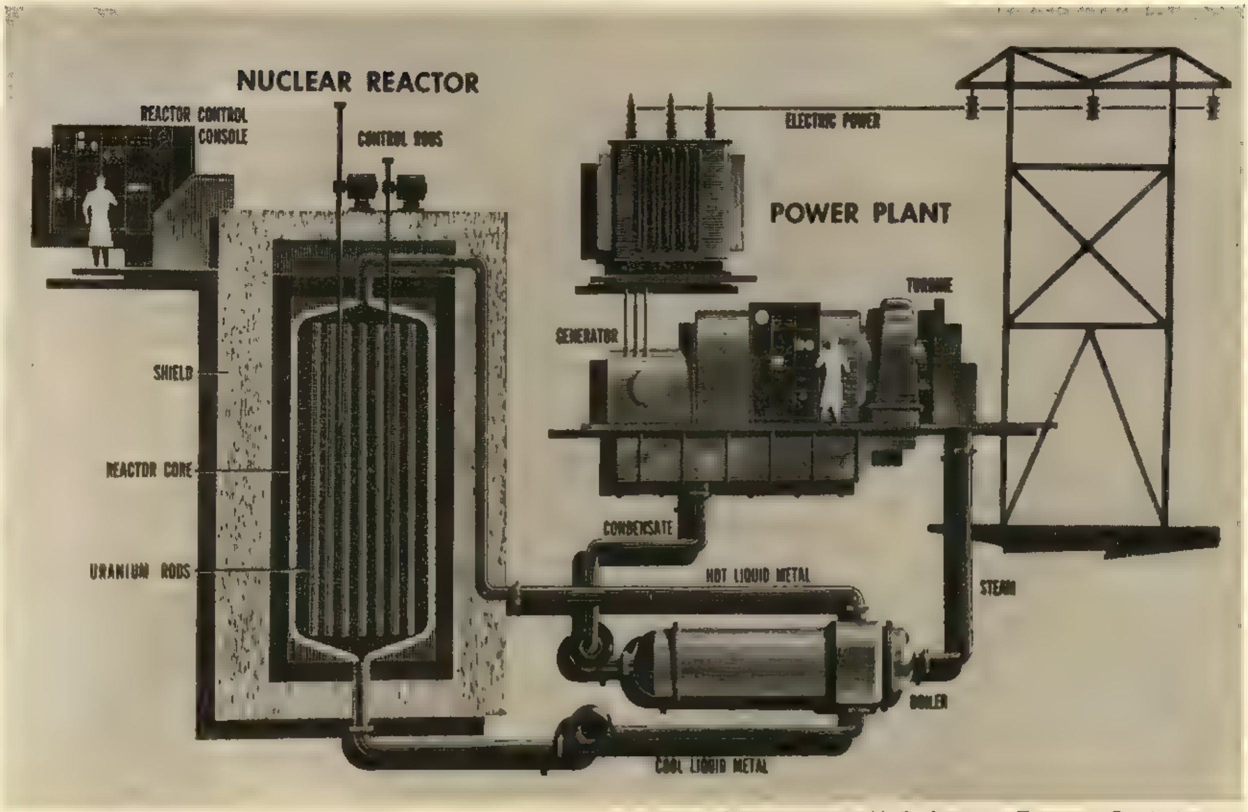
Atomic energy, for which scientists are continually seeking new applications, may be produced through two processes called fission and fusion. In fission, atoms of elements, such as uranium and plutonium, are split. In fusion, atoms of light elements such as hydrogen are combined. Tremendous amounts of energy are created by these processes. Atomic bombs are an application of deliberately uncontrolled and explosive release of energy through the use of the fission and fusion processes. Nonweapon applications of these processes require that release of the tremendous amounts of energy be controlled carefully. Scientists have developed practical methods of controlling the fission reaction, but have not yet mastered control of the fusion reaction.



Reactor operators loading long aluminum tubes containing pure uranium metal into a nuclear reactor.

Controlled fission is produced in a nuclear reactor which can be thought of as an atomic furnace. A specific mass of fissionable fuel, such as uranium, is placed in a particular arrangement with certain other elements in a heavy metal vessel. The mass of fuel is sufficient to sustain what is called a chain reaction. This reaction in a nuclear furnace results in a continuous and controlled fissioning (or splitting) of uranium atoms and produces a large quantity of energy in the form of heat and radiation. The level of the reaction may be directly controlled by rods of special metals like cadmium, boron, and hafnium which are inserted into the fuel chamber, or "pile" as it is often called, to regulate or stop the reaction.

Both atomic fusion and fission take place in nature. Fusion is generally believed to be the



COURTESY OF U. S. ATOMIC ENERGY COMMISSION

Use of the nuclear reactor in generating electricity.

source of the energy of the sun. Atomic fission takes place close to the earth through the interaction of cosmic rays. This is part of what is known as natural background radiation. Prior to the Atomic Age, X-rays were the most commonly known form of radiation. Radiation that arises during fission is called nuclear radiation because it comes from the nucleus of the atom. Nuclear radiation can penetrate matter. It is invisible and therefore usually identifiable only by sensitive recording instruments. This type of radiation is dangerous to man. For that reason, the nuclear furnace is housed in a special container and surrounded by sufficient thickness of shielding materials such as concrete and lead so that the nuclear radiation is absorbed.

The uranium atoms used as fuel in nuclear reactors give off radiation in the form of neutrons, one of the major particles inside the atomic nucleus. These free neutrons smash into the nuclei (or centers) of other uranium atoms and break them in two. The process of splitting releases energy and several kinds of nuclear radiation. Radioactive atoms of other kinds of elements such as barium, sesium, and iodine are derived from the splitting process. The newly formed atoms are called radioactive because they give off nuclear radiation. They are also called radioisotopes.

Radioisotopes created during the fission process can be extracted from the fuel core of the reactor by chemical processes. Hundreds of different radioisotopes can also be made by exposing stable atoms to neutrons emanating from the reactor core (or furnace). Some radioisotopes are made in particle accelerators, commonly called "atom smashing" machines.

Thus, harnessed atomic energy is produced in a nuclear reactor in the form of heat and radiation. The reactor like other kinds of furnaces needs fuel to operate. Reactors are fueled principally with two kinds of uranium. The first is called natural uranium. It contains a small quantity (0.7 of 1 percent) of the fissionable isotope, uranium U–235. The remaining atoms are mostly uranium U–238. When the U–235 atoms split, they release "atomic bullets" called neutrons which can be made to split some of the U–238 atoms.

These in turn release additional neutrons which can similarly split more atoms. This is how the fission process or "chain reaction" is started and maintained. One result of this type of reaction is the absorption of neutrons by U–238 which later becomes plutonium, a manmade fissionable and radioactive element whose chief use so far is in weapons. However, a more powerful and efficient type of reactor fuel than natural uranium can be made by separating the U–235 atoms from the U–238 atoms and concentrating the former in metal or solution for reactor fuel. This is the fuel referred to as "enriched uranium." A third reactor fuel not yet in wide use is obtained by converting the metal thorium into a fissionable material, U–233, by neutron absorption. Hence, these three kinds of material are all manufactured for reactor fueling.

Applications of Atomic Energy

The heat and radiation produced in reactors can be used in a number of ways. The major nonweapon uses appear to be the production of electricity, the propulsion of ships and submarines, the heating of buildings, many applications in medicine and agriculture, as a research tool, and as a means of product control in industry. Perhaps the greatest single nonweapon use of atomic energy will be the use of heat from reactors for production of electricity. Economic production of electricity from nuclear power plants had not been achieved by the end of 1956, but a vast multimillion dollar experimental and demonstration program was in progress to achieve this end.

Heat from reactors can be converted into propulsive power. Reactors already power submarines and will be used to propel surface ships. Intensive research toward developing a reactor to power aircraft is in progress, and a reactor to drive locomotives is being studied.

Reactors can be built primarily as a radiation source. As such, they are used for many kinds of research and are being developed into versatile training and experimental facilities for use in nuclear research centers, universities, and laboratories. In addition, they are being given serious study as high intensity radiation sources to catalyze chemical reactions, process materials, and for other applications exploiting the unique properties of radiation.

Reactors are also utilized for the manufacture of radioisotopes, which have extensive applications in medicine, industry, agriculture, and research generally. Radioisotopes give off radiation in the form of several types of rays. These rays can penetrate matter in varying degrees and are used in three general ways. One is the irradiation of materials to change their properties—for example, the irradiation of potatoes and other food to prevent decay (or destroy infecting organisms), the irradiation of cancer tissues to destroy them, and the exposure of seeds to radiation to develop better strains. Radiation is also used for measurement. For example, the thickness of metal or the liquid level in a closed container can be determined through measuring by instrument the amount of radiation penetrating the substance. Industry uses this method in product control. Lastly, the rays from radioisotopes can be used as tracers. Radioisotopes can be placed in the blood stream of men and animals, for example, and their movements traced by instruments recording the emitted rays. Tracing is the most important use of radioisotopes to date and is used widely in medicine, agriculture, and industry.

Nature of the Atomic Energy Field

Many different activities are required for the production and application of nuclear energy. These include the mining and milling of ores, the refining of ore into metal, the manufacture of nuclear fuels (uranium U–235 and plutonium), the manufacture of reactors and components, the operation and maintenance of reactors, the application of radioisotopes and high intensity sources of radiation, and research of various kinds in industry and universities.

Many of the basic atomic energy activities are supported by the Federal Government. The Atomic Energy Commission directs the Federal Government's atomic energy program. The work program is contracted out to private organizations which operate Commission-owned facilities that were valued at more than $6 billion in 1956. These facilities include laboratories, uranium processing plants, nuclear reactors, and weapon manufacturing plants. It has been estimated that more than 75 percent of the Commission's expenditures are for development and production of military weapons.

The Commission owns many research and development centers that are operated by private organizations. Employment in these centers totaled about 30,000 late in 1956. Three of these centers—Oak Ridge (Oak Ridge, Tenn.), Argonne (Chicago, Ill.), and Brookhaven (Long Island, N. Y.) National Laboratories—carry on research in the physical and life sciences and in the reactor development field. They also build experimental reactors, particle accelerators, and other types of atomic energy equipment. Oak Ridge National Laboratory is a major producer and distributor of radioactive and stable isotopes.

The Commission contracts with private companies and research laboratories for additional research in geology, medicine, biology, metallurgy, reactor development, waste disposal, reactor component manufacture, etc. It also supports extensive basic scientific research in universities.

Of course, much independent research in atomic energy is carried on without financial assistance from the Commission. Furthermore, the Commission encourages private participation in the atomic energy field by making available, to the fullest extent possible, scientific data on atomic energy, Government-owned facilities for running experiments, and equipment for scientific projects. It also provides financial help to private organizations for the construction and operation of research and power reactors, atom smashing machines, and other atomic energy facilities, and makes available the necessary fuel.

Private concerns in their own installations are engaged in every type of atomic energy activity except development and production of military weapons and certain nuclear fuel processing operations. Many of these activities such as ore mining and milling, refining of metals, manufacture of heat transfer equipment and instruments, and construction of facilities differ little from non-atomic energy operations of the same sort. Other activities such as manufacture of the fuels needed to run reactors are unique to the atomic energy field.

Private concerns also produce many materials for use in atomic energy equipment. These materials, depending upon their function, must be able to stand heat, corrosion, or radiation, and must have special properties such as the ability to slow down neutrons, absorb them, or be impervious to them. A number of companies are also engaged in the development and design of reactors. Reactor manufacturers may make the reactor core, which contains the nuclear fuel and other elements, as well as the control rods or other integral pieces of the reactor, but much of the work is subcontracted to companies specializing in the manufacture of such items as steel vessels, heat transfer equipment, pumps and valves, instruments and controls, and shielding materials. Another group of companies specializes in designing and engineering building facilities for nuclear reactors and their auxiliary equipment, atomic energy research laboratories, and nuclear fuel processing plants.

Atomic energy activities are found throughout the United States. These activities are in progress in every State through a university, a hospital, a manufacturer, a mine, or a Commission-owned installation.

Jobs in the Atomic Energy Field

A relatively high proportion of the more than 150,000 workers in the atomic energy field in late 1956 were scientists, engineers, and technicians, as well as skilled craftsmen. This high proportion of technical and professional workers is a result of the large amount of research and development and pilot work now being conducted in this field. However, in some of the activities, such as mining, the occupational distribution is similar to that of comparable non-atomic work. The following is a brief description of the types of workers employed in some of the important atomic energy activities.

Uranium Mining

The types of workers employed in uranium mining are similar to those in mining of other metal ores. Small mines may be worked by 2 or 3 men; larger mines by several hundred. About 9,000 workers were engaged in uranium mining operations in late 1956. They were largely concentrated in the Colorado Plateau area of the Far West, in the States of Colorado, Utah, New Mexico, Arizona, and Wyoming. About 11 percent of the employees in uranium mining were in professional and technical jobs. Mining engineers and geologists were the chief professional employees. Among operating employees, the largest groups

were miners in underground mines and truckers, bulldozer operators, and loaders in open pit mines.

Uranium Ore Milling

The milling of uranium ore is not unlike that associated with other types of metallic ores. Mills use metallurgical and chemical processes to extract uranium from ore. Uranium ore milling employment was estimated at more than 2,000 in late 1956. Mills were generally located on the Colorado Plateau.

Since mills were primarily engaged in production, the ratio of professional and technical employees was relatively low (9 percent). Professionals employed in ore milling include chemists and metallurgical, mechanical, and electrical engineers. Maintenance requires pipefitters, welders, electricians, carpenters, and machinists.

Uranium Refining

In uranium refining plants, the milled uranium is chemically processed to remove impurities and then converted to a metal or other chemical compound. More than 3,000 workers were employed by uranium refining plants in late 1956.

Managerial, supervisory, and professional workers accounted for about 18 percent of all employees in uranium refining. Chemical engineers and chemists were employed in substantial numbers. Processing operations accounted for the largest proportion of employment. Chemical operators made up the largest individual processing occupation. Machine tool operators who cut uranium metal to shape and skilled maintenance workers such as pipefitters, instrument repairmen, electricians, and millwrights were employed in fairly large numbers.

Enrichment of Uranium

Uranium enriched in varying degrees with U-235 atoms is produced in huge plants that separate the fissionable U-235 atoms from the nonfissionable U-238 atoms by the process known as gaseous diffusion. More than 10,000 workers were employed in late 1956 in these plants.

Employment in uranium enriching plants was distributed among major occupational groups in the following proportions:

	Percent
Total employment	100.0
Managerial, supervisory, and professional	20.0
Clerical and office	18.0
Maintenance	30.1
Processing	19.5
Other workers	12.4

Maintenance in these chemical plants accounted for 30 percent of employment. Important maintenance occupations were maintenance mechanics, instrument mechanics, electricians, pipefitters, millwrights, and rigger-ironworkers. Chemical operators in processing operations comprised the largest single occupation.

Chemical engineers and chemists comprised the largest occupations among professional employees. Substantial numbers of electrical and mechanical engineers, physicists, and mathematicians were also employed.

Reactor Manufacturing

A few thousand workers were employed by reactor manufacturers in late 1956. Reactor manufacturers are engaged in research and development work on reactors and auxiliary equipment. They manufacture fuel elements, control rod mechanisms, pressure vessels, pumps and valves, and heat transfer equipment. Many of their production activities are very similar to those in machinery manufacturing.

Engineers made up about 19 percent of reactor manufacture and development employment in late 1956. They included nuclear as well as other types of engineers. They were engaged in design and development of reactor cores and other integral parts of the reactor. Physicists, mathematicians, draftsmen, and laboratory technicians were also employed in sizable numbers. There were many skilled craftsmen employed in both experimental and production work. Of total reactor manufacturing employment, inspectors and testers accounted for 11 percent; other types of workers employed were machine-tool operators, machinists, and welders.

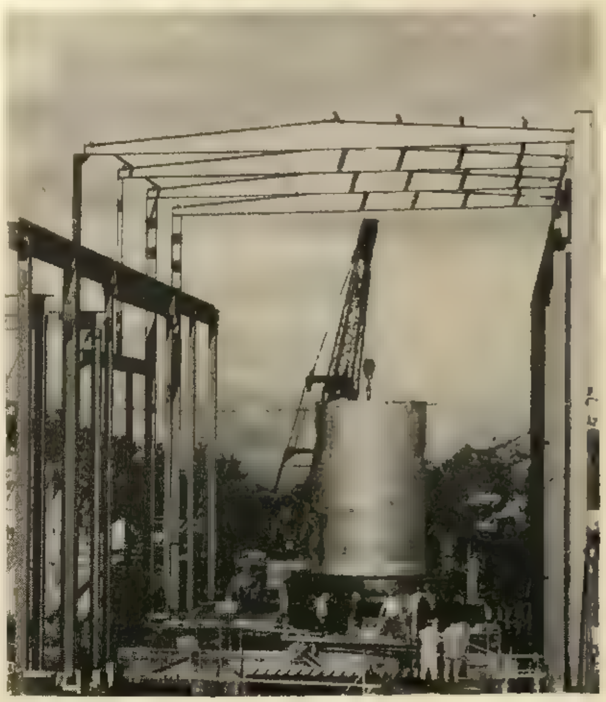
Radiation Instrument Manufacturing

Several thousand workers were employed in 1956 in manufacturing radiation instruments, which detect and analyze radiation. Production of these instruments involves work similar to that

in instrument manufacturing in general. Professional and technical employees represent a large proportion of employment in most companies. Engineers are the largest scientific group. Physicists, chemists, and draftsmen are also employed. Among the craftsmen are modelmakers, machinists, and instrument makers.

Construction of Facilities

Thousands of workers are engaged in designing, engineering, and constructing nuclear reactor housing, atomic energy laboratories, reactor manufacturing plants, and reactor fuel processing plants. Several companies specialize in planning and designing these installations and provide consulting engineering help to companies doing the actual construction. In these companies, engineers made up 30 percent of total employment in 1956, and designers and draftsmen each made up another 20 percent. Companies undertaking the actual construction employ all construction crafts including boilermakers, bricklayers, carpenters, cement finishers, steamfitters, plumbers, painters, electricians, ironworkers, sheet-metal workers, and operating engineers.



Thousands of workers are engaged in constructing atomic energy installations. Here the container housing the core of a nuclear reactor in which fission takes place is being lowered into position.

Reactor Operation and Maintenance

Many nuclear reactors were operating in late 1956 in Commission-owned facilities and nuclear-powered submarines. Occupations typically needed for the operation of reactors include reactor operators (licensed by the Commission); reactor engineers; health physicists; and technicians. Among the employees needed to maintain and repair reactors are instrument engineers, instrument technicians, electricians, plumbers, mechanics, and machinists.

Research and Development Centers

Research and development centers that are operated by private organizations for the Atomic Energy Commission employed about 30,000 workers in late 1956. These workers devoted most of their time to atomic energy research which involves the use of laboratory facilities, machine shops, welding and sheet-metal shops, and reactor and atom smashing machines (particle accelerators).

Employment in a typical center was distributed among major occupational groups in the following proportion:

	Percent
Total employment	100.0
Managerial, supervisory, and professional	40.2
Clerical	10.2
Technicians and craftsmen	23.7
Maintenance	8.6
Other workers	17.3

Engineers and scientists made up more than 27 percent of total employment in a typical center. Engineers alone accounted for nearly 12 percent; physicists, nearly 5 percent; and chemists, 4 percent. In the technicians and craftsmen group, research technicians comprised 11 percent of total employment and machinists accounted for 4 percent.

Government Employment

The Atomic Energy Commission directs the Federal Government's atomic energy program. About 6,600 persons were employed in its national and field offices in late 1956. Included among the Atomic Energy personnel are a relatively large proportion of engineers, geologists, chemists, and physicists. The Commission's work program is generally contracted out to private organizations.

In addition to employees of the Atomic Energy Commission, there are Government employees engaged in atomic energy work in other Federal agencies and in labor and health departments in a few individual States. Their duties involve research and application of atomic energy and preparation and implementation of radiation health and safety measures.

The United States Department of Defense employs engineers, as well as nuclear physicists, nuclear chemists, health physicists, geophysicists, and mathematicians in its atomic energy work. The United States Geological Survey employs mineralogists, geologists, chemists, physicists, and many other supporting employees. United States Department of Agriculture employees use radioisotopes extensively in research work. Included among these employees are physicists, chemists, entomologists, plant physiologists, and soil scientists.

The United States Department of Health, Education, and Welfare is concerned with radiation health hazards. With the cooperation of the Atomic Energy Commission, it aids States in establishing measures to meet this problem. The Department had engineers, physicists, chemists, and doctors engaged in this work in 1956. The United States Department of Labor is also interested in industrial safety problems in the atomic energy field.

Unique Atomic Energy Occupations

The preceding discussion dealt in broad terms with ocupational employment in various atomic energy activities. Most of these occupations are found in other industrial activities. However, there are a few occupations which are relatively unique to the atomic energy field and for this reason are discussed more fully below. In addition, the nuclear engineer and nuclear physicist occupations are discussed elsewhere in this Handbook. (See index for page numbers.)

Health Physicist. This occupation is concerned with the problem of radiation safety for workers in atomic energy installations and for people in the surrounding community. Health physicists protect individuals and property from the hazards of radiation by detecting the radiation and con-

A health physicist (left) using a survey meter containing a Geiger counter to make sure that personnel are not exposed to dangerous amounts of radiation.

trolling exposures. They are professional workers with considerable responsibility and usually are assisted by junior health physicists, radiation analysts, health physics techniques, and monitors.

The excellent radiation safety record in the 10 years of Commission operation of the Nation's atomic energy program is a testament to the effectiveness of radiological protection techniques that the health physicists have developed.

Health physicists are responsible for planning and organizing various phases of an atomic energy facility's health program. They set up standards of inspection and establish procedures for eliminating radiological hazards. In some cases, they are employed on experimental and developmental projects involving radiological toxicity or the development of better detection devices, safety equipment, and procedures. They may also plan and supervise training programs in respect to radiation hazards. Other functions are to direct surveys on radiological hazards or radiochemical toxicology and to prepare reports.

Health physicists supervise the inspection of work areas and equipment where radiation hazards exist and investigate specific problems involving hazardous materials. In addition, they assist in the development of better methods and equipment for detection and control. Another duty involves

the preparation of routine and special reports on radioactive materials.

Health physicists recommend procedures for protecting employees and prepare instructions for use by operational employees. Shipments of equipment and materials are inspected by health physicists to insure compliance with Government standards and regulations. They also cooperate with plant doctors on the need for, and scheduling of, medical examinations. Finally, they may recommend procedures to be followed in using radiotoxicants in research and developmental processes.

Health physicists are employed at nuclear reactor sites and wherever sizable amounts of radioactive materials are on hand. Frequently, their jobs are located away from populated areas.

Health Physics Technicians. These technicians normally work under the supervision of a health physicist. They process, read, and record data from radiation monitoring film and perform other special microscopy studies. Some of their other duties include checking and servicing radiation instruments and checking clothing with special radiation-counting equipment. In some cases, they may be engaged in experimental work.

Inspectors or Monitors. Health physics inspectors or monitors use special instruments in checking work areas, tools, and equipment for radiation and radioactive contamination. They determine whether an area is safe to work in or whether equipment is safe to use. Inspectors set safe working time limits for employees in hazardous areas in relation to radiation tolerances. They also check incoming and outgoing shipments of radioisotopes for radiation levels and contamination. Soil and water samples are taken in waste disposal areas and checked. Finally, inspectors make reports and give oral advice concerning radiation hazards. They work under the supervision of health physicists.

Decontamination Technicians. The primary function of decontamination technicians, sometimes called reclamation men, is to decontaminate people, equipment, plant areas, and materials exposed to radiation. They use radiation-detection instruments to locate the contamination and later to check the effectiveness of their decontamination measures.

Other Health Physics Occupations. In addition to the four principal health physics occupations described above, there are other job specialties. There are, for example, workers who transport and dispose of radioactive materials. Also, a group of operators who use equipment for treating waste water, sewage, and other materials to reduce the amount of radiation. They are assisted by helpers and laborers. A sizable group of workers is employed in decontaminating gloves and clothing before they are laundered. Radiation safety representatives promote radiation safety programs and supervise safety coverage in an assigned area. A few workers specialize in the maintenance and calibration of detection instruments.

Training and Other Qualifications

The training and educational requirements for workers in atomic energy activities are generally similar to those required for comparable jobs in other fields and are discussed elsewhere in this Handbook under the specific occupations. (See index for page numbers.) Security clearance is required for employees handling classified data or working on classified projects and for all Atomic Energy Commission employees.

There are stricter performance requirements for some of the craft jobs in installing and maintaining equipment and machines involved in atomic radiation than in comparable jobs in other fields. Plumbers, pipefitters, machinists, boilermakers, electricians, and welders may be required to work to somewhat more exacting tolerances than those allowed in ordinary industrial work. This kind of precision is needed, for example, to insure safety and health protection in constructing and maintaining atomic reactors and related equipment.

The Atomic Energy Commission supports an extensive educational program to assist in preparing trained scientists, engineers, technicians, and other workers for the growing atomic energy field. The Commission runs two reactor training schools, trains people at its contractor operated facilities, and offers special fellowships. The Commission also offers schools financial assistance for the purchase of equipment and education aids to be used in atomic energy education and furnishes nuclear fuels and other special materials for such purposes.

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The Commission's Oak Ridge School of Reactor Technology for training personnel in nuclear energy technology offers a 1-year program and enrolls students sponsored by American companies and Government agencies. The International School of Nuclear Science and Engineering accepts foreign nationals and students sponsored by American firms and offers a 34-week program in nuclear energy technology. The Oak Ridge Institute of Nuclear Studies, which is run by an association of 34 colleges under Commission contract, provides training in the safe and efficient use of radioisotopes. Between 1946 and the end of 1956, more than 2,000 persons had taken its 28-day training course.

Several of the Commission laboratories offer additional educational and training opportunities. Temporary employment at laboratories is available to faculty members and undergraduate students. Engineering undergraduates may work at laboratories on a rotation basis with classroom work. Graduate students may do their thesis work at laboratories. The laboratories also give on-the-job training to personnel from industry, Government agencies, and the Armed Forces.

The Commission also offers fellowships in radiological (or health) physics, industrial hygiene, industrial medicine, and nuclear energy technology. Participants under these fellowships receive training in universities and in Commission laboratories.

The following is a discussion of training, education, and other qualifications for jobs which are unique in the field of atomic energy. A bachelor's degree in physics, chemistry, biology, or engineering and about 1 year of graduate work in health physics are preferred by organizations with job openings for health physicists. In some cases, related technical training and experience can be substituted for part of the academic requirement.

The Atomic Energy Commission in the 1956–57 scholastic year offered fellowships for graduate work in this field at 4 universities. The fellowships combine academic study at a university and practical training at installations of the Commission. The program is conducted at Vanderbilt University and Oak Ridge National Laboratory; the University of Rochester and Brookhaven National Laboratory; and the universities of Washington and Kansas and the Hanford Works. By 1956, these universities had trained between 260 and 280 individuals. These schools graduate from 80 to 90 health physicists each year. In the training program, health physicists attend university lectures during the academic year, and during the summer months at the AEC installations, they perform actual work involving problems of monitoring (measurement of radiation level), instrument adjustment, shielding, and waste disposal associated with reactors, high voltage machines, X-ray facilities, metal-preparation and metal-recovery laboratories and plants.

Some of the other unique health physics occupations do not require college training. For example, a high school education and some experience in health physics work or equivalent special training or education is required for the job of the health physics technician. Familiarity with electronic instruments and laboratory techniques are essential requirements. Special training in health physics and a high school education are requisites for inspectors or monitors. These workers must be familiar with some of the characteristics of radiation, maximum permissible exposure values, and methods of calculating exposure times. They must also know how to use radiation detection instruments. High school graduates, after receiving some formal technical instruction and on-the-job training, can become decontamination technicians. They are regarded as fully qualified after 15 months' experience on the job.

Employment Outlook

Atomic energy is a relatively new field which promises long-range growth in employment. There will be an increased need for trained professional and skilled personnel in a growing number of activities with the more widespread application of nuclear energy. At the present time, most of the employment is in research and development.

Additional nuclear fuel processing activities will probably result in increasing employment in uranium milling, refining, and processing operations. Growth in reactor manufacturing employment is also expected particularly in plants which fabricate fuel elements and offer reprocessing services for fuel and waste disposal.

By 1956, a number of private electric utility companies had already contracted for reactors for nuclear powerplants. In the 1960's, there should be a number of such plants in operation offering

employment opportunities for reactor operating and maintenance personnel. Other sources of employment will be universities and industrial laboratories having reactors.

Employment expansion can also be expected in laboratories processing radioisotopes. Employment may substantially increase in plants making control equipment and radiation recording and detection instruments because of the general expansion in the atomic energy field.

Trained technical workers and skilled craftsmen will be required in considerable numbers in the late 1950's and the 1960's in nuclear energy activities. Particular need will exist for chemists, nuclear physicists, mathematicians, biologists, biochemists, nuclear and other types of engineers, and people in the health physics occupations. There will be an increased need for skilled workers such as welders, sheet-metal workers, machinists, pipefitters, and tool and die makers.

Earnings and Working Conditions

Information on earnings in individual occupations in atomic energy activities is not available. However, indications are that the earnings in some nuclear energy activities were higher than in comparable nonnuclear energy plants. In December 1956, production workers employed by private contractors at the Atomic Energy Commission's installations were averaging $2.51 an hour. This compares, for example, with the average of $2.05 for all production workers in manufacturing industries in the same month. (Earnings data for many of the occupations found in the atomic energy field are included in the statements on those occupations elsewhere in this Handbook. See index for page numbers.)

Most workers in the atomic energy field receive 2 or 3 weeks' vacation with pay, depending on their length of service. In addition, most firms have group life, health, and accident insurance and retirement plans.

Working conditions in the atomic energy field vary with the type of job and the place of employment. In uranium mining, milling, instrument and auxiliary equipment manufacturing, and facilities construction, working conditions are similar to those for nonatomic energy activities of the same type. But in the other occupations which constitute the major proportion of the atomic energy field, working conditions are generally unusually good. Buildings and plants are relatively new and are well lighted and ventilated. The surroundings are also pleasant, because the buildings are often spread out over wide land areas. Equipment, tools, and machines are modern and, sometimes, the most advanced of their type.

Health and safety are a primary concern. As a result, extensive safeguards have been established to protect workers. However, only a small proportion of employees in the atomic energy field work in areas where direct radiation dangers exist.

Most plant workers belong to unions. Among the unions which have organized members in the atomic energy field are: the International Association of Machinists; Oil, Chemical and Atomic Workers International Union; local councils of the Metal Trades Department, AFL–CIO; and the International Union, United Plant Guard Workers of America (Ind.).

Where To Go for More Information

Information on all aspects of employment in the atomic energy field may be obtained by writing to the Division of Organization and Personnel, Atomic Energy Commission, 1901 Constitution Ave. NW., Washington 25, D. C.

OCCUPATIONS IN THE AUTOMOBILE INDUSTRY

The Automobile Industry and Its Workers

In the brief 60-odd years of its existence, the automobile industry has grown from an experiment concerned with the development of a horseless carriage to one of the most important of America's manufacturing industries. This industry, which in the 1890's occupied the attention of a few inventive mechanics working in small sheds and shops, is now among the Nation's largest employers.

By the end of 1956, more than 65 million cars, trucks, and buses were traveling the Nation's streets and highways. Nearly 7 million of these motor vehicles were built during 1956. The industry has produced an average of 7.2 million vehicles each year since 1950.

The automobile industry is a source of employment for workers with widely different levels of education and skill. Requirements for jobs vary from college degrees for engineers and other technical personnel to a few days of on-the-job training for some of the less skilled assemblers. The largest number of employees work in factory occupations. These jobs range from the skilled tool and die makers, millwrights, and electricians, to the less skilled machine tool operators, assemblers, and material handlers. A great number of automotive employees also work in office and administrative jobs as clerks, business machine operators, stenographers, accountants, purchasing agents, market analysts, and industrial relations personnel.

Nature and Location of the Industry

This industry has not only helped to develop existing industries but has also created new ones. It is the most important consumer of such basic commodities as steel, rubber, and plate glass. Moreover, new businesses, including automotive repair shops, service stations, and truck and bus transportation, have developed as a result of the automobile.

The tremendous growth of this industry is due primarily to the mass production of standardized parts. Thousands of identical parts are produced by workers whose jobs are divided into a limited number of operations on high speed automatic machinery. These mass-produced parts are then put together by assemblers to form the completed vehicle. Because of the minute division of labor, cars can be driven off assembly lines at the astounding rate of 1 every 60 seconds.

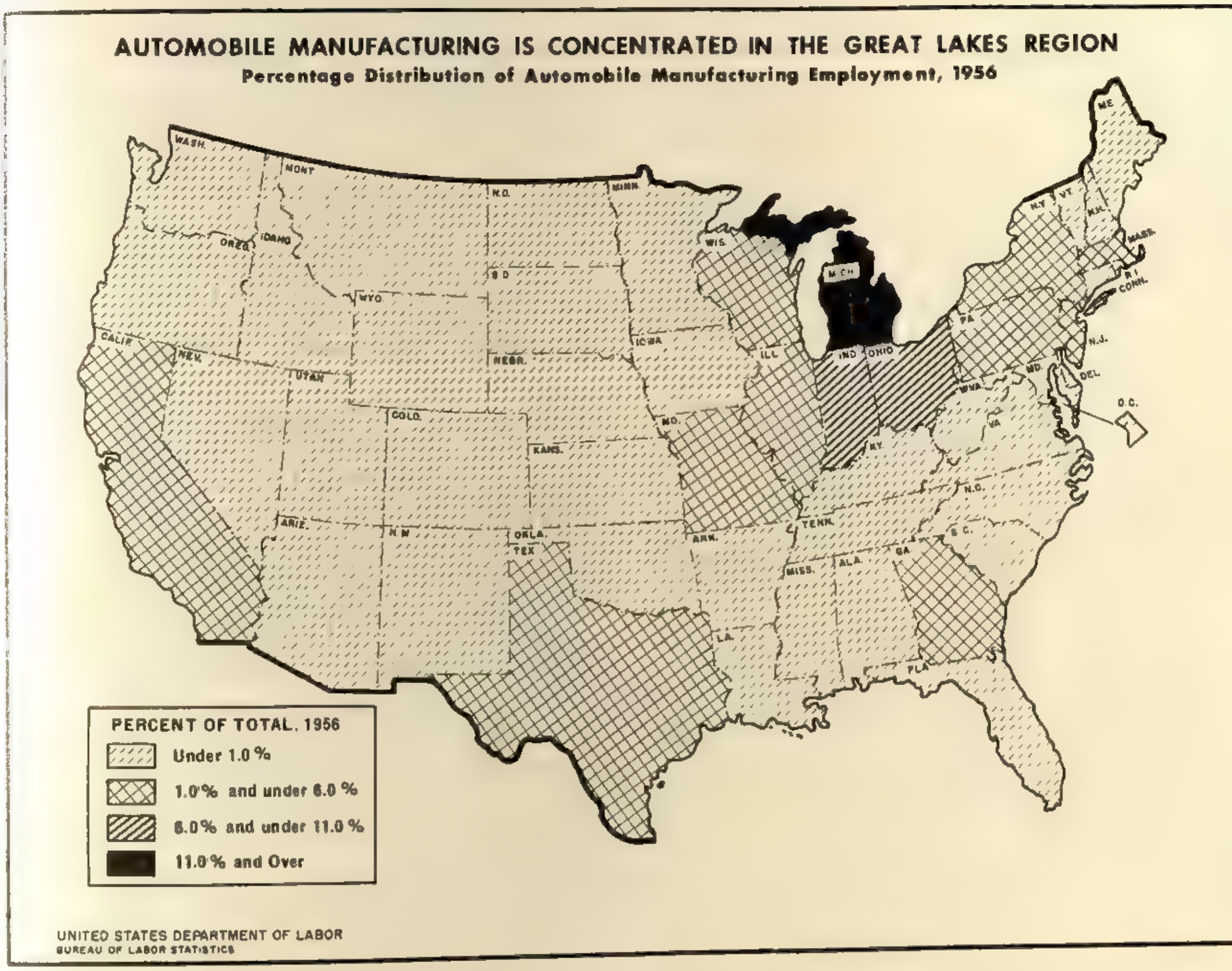
The automobile industry consisted in 1956 of some 1,600 plants which manufactured parts and assembled these parts into motor vehicles of all types. These plants ranged in size from huge assembly plants employing many thousands of workers to parts plants employing a small number of workers. About 60 percent of the automobile workers were employed in establishments with 2,500 or more employees.

Hundreds of companies supply the parts or subassemblies for new automobiles and also produce the replacement parts necessary to keep the millions of vehicles already on the road in operation. These firms often specialize in producing such parts as brakes and clutches for automobiles and trucks. About 40 percent of the automobile workers are employed in these parts-manufacturing plants. Only a few companies produce the completed vehicles—passenger cars, trucks, buses, and special-purpose vehicles such as ambulances, fire engines, and taxicabs.

Jobs in the automobile industry are found in almost every State in the country. However, automobile manufacturing is concentrated in the Great Lakes region where almost four-fifths of the workers are employed. Michigan alone accounted for more than half of the industry's employment in 1956. Together the 2 neighboring States of Ohio and Indiana had another 17 percent. Ten other States each employed 10,000 or more workers. They were New York, California, Wisconsin, Pennsylvania, Illinois, Missouri, New Jersey, Georgia, Massachusetts, and Texas. (See chart 45.)

The Detroit metropolitan area is the center of the industry. About 1 out of every 3 of the Nation's automobile workers is employed within

CHART 45



its industrial area, which includes the nearby communities of Dearborn and Pontiac. Several other Michigan cities, especially Flint, Lansing, and Saginaw, employ large numbers of automobile workers. The Great Lakes region has many other important centers: Cleveland, Toledo, and Cincinnati, Ohio; South Bend, Indianapolis, and Fort Wayne, Ind.; Chicago, Ill.; and Milwaukee and Kenosha, Wis.

Much of the automobile manufacturing on the East Coast is centered in the New York–Northeastern New Jersey industrial area in such localities as Newark, Linden, and New Brunswick, N. J.; and New York and Tarrytown, N. Y. The Los Angeles industrial area is not only the leading automobile manufacturing center in the Pacific Coast region, but it is second only to Detroit in the number of motor vehicles assembled. Oakland is another automobile manufacturing center in California.

How Automobiles Are Made

The modern automobile represents an engineering triumph matched by few other mechanical products. The mass production of standardized parts and assembly-line manufacturing methods enable the automobile industry to produce millions of these complicated products each year.

Motor vehicles are produced in three major stages. The first step is the preliminary planning and engineering, the second is the production of motor vehicle parts and subassemblies, and the third is the final assembly of parts into completed vehicles.

Planning For New Model Production. In order to carry out the first stage of designing and planning, the major automobile producers maintain research laboratories and technical staffs to improve their models. Engineers, body stylists, and

fabric designers contribute their skills to develop new automobile designs about 1 to 5 years in advance of production. Clay, wood, and plastic models of the new automobile model are made from ideas worked out on the drafting board. The models determine the styling and design of the final car. For the mass production of the car, master dies are made from the finally accepted model. Throughout this initial stage of producing an automobile, parts companies work closely with the automobile manufacturers on questions of designing, engineering, and tooling. Problems of production methods, costs, and scheduling are also worked out long before the actual manufacturing process begins.

Making Automobile Parts. The manufacture of motor vehicle parts and subassemblies is the second stage of automobile production. After the design of the new model automobile is developed, automobile parts plants begin production of the various components of the car. Because parts are made by many different firms, rigid quality control is maintained to insure that the parts fit properly on the final assembly line.

Motor vehicle parts are made of many different materials. Most of the parts are made from steel, copper, or aluminum. Some of the parts, however, contain plastic, rubber, fabric, or glass. Metal parts for motor vehicles can be shaped in several ways depending upon the purpose for which the part is to be used, the size of the part, and the type of metal used. The principal methods of shaping metal are casting, forging, machining, and stamping.

Castings are made in foundries where molten metal is poured into molds and allowed to cool and harden into the desired shape. Bulky parts, such as engine blocks, generally are made by the casting process. In the forge shops, metal is heated and then pounded into the desired form by mechanical steam hammers and forging presses. The forging process shapes metal objects which are required to withstand great stress, such as automobile crankshafts and connecting rods. Generally, parts that are produced by casting or forging must undergo further processing, usually machining, before being ready for assembly.

Machining is the metalworking process best adapted for the production of parts to precise sizes. It is a process of cutting or chipping metal from rough castings, forgings, and bars by the use of power-driven machine tools. Among the more common types of machine tools are lathes, boring machines, drill presses, grinding machines, milling machines, and gear cutters. The machine tools are used to turn, drill, grind, cut, and smooth metal parts to exact sizes. Hundreds of machining operations are required to complete some of the more intricate parts such as engine blocks, pistons, ring gears, connecting rods, camshafts, and crankshafts.

The automobile industry has taken the lead in trying to develop continuous automatic production for many of its machining operations. This approach to production has been called "automation," i. e., the use of instruments to direct and control manufacturing processes. In applying automation to machining processes, automobile manufacturers have linked automatic machine tools to perform a variety of machining operations. Less labor is required because the parts or pieces being machined are not handled manually.

For example, one large motor vehicle producer has built an automated engine plant in which a rough engine block goes through 530 different cutting, drilling, and grinding operations with the use of little or no manual labor. The engine block is moved into and out of load stations mechanically, machined automatically by a battery of machine tools, and transferred by conveyors to the next machining operation. Much of the inspection is done automatically. The machine tools, the conveyors, and the inspection equipment are often controlled by electronic, hydraulic, or air control mechanisms. Workers attend the automated lines of machine tools by watching the panel-control-boards for interruptions of the machines' normal functioning.

Another important manufacturing operation is the stamping process. The large sections of the body of the car are formed from sheet steel shaped by huge electronically controlled presses. Smaller parts of the vehicle are also stamped or pressed out of sheet steel or aluminum.

The production of parts does not entirely consist of metalworking operations. For example, to make body parts rustproof and attractive, they are spray-painted and then baked in ovens lined with infrared lights. Also upholstery for the car interior is cut, sewn, and installed.

Throughout the production of parts numerous inspections are made to insure that the quality of the assembled vehicles will meet established standards. Such inspection begins with a spot check of incoming raw materials from which parts are to be made. All machined parts are carefully inspected so that they will not vary from the specified size limits.

Assembling the Final Product. The last stage of motor vehicle manufacturing takes place on the final assembly line. Final assembly is the process of putting together in sequence the individual parts and the subassemblies, with the completed vehicle rolling off the end of the line. Overhead wires feed electric power to nut tighteners, welding equipment, and other tools used by workers on the assembly line. A conveyor moves at floor level carrying the motor vehicle forward while men at work stations attach the necessary parts and subassemblies in proper sequence.

Generally, the assembly of a car starts with the frame which forms the foundation of the motor vehicle. All other parts and subassemblies are attached to it. Large and heavy subassemblies, such as the engine and the body, are lowered by hoists into position on the chassis as it comes down the line. The finishing accessories such as bumpers, hubcaps, and floor mats are added near the end of the line. Finally, the headlights are adjusted, the wheels are alined, and gasoline is pumped into the fuel tank, and thus another new motor vehicle is driven off the line under its own power. The finished car is thoroughly inspected before it leaves the factory.

As the many chassis move down the assembly line, "banks" of material located in aisles along the line are continually fed to the assemblers in accordance with a careful system of scheduling arranged by the production control department. Behind the movement of the parts and subassemblies to the assembly line is the work of the materials control men who, months before, coordinated the movement of material from outside suppliers with a planned production schedule.

The sequence of the models to be built may be transmitted to the various stations along the line by either teletype or telautograph. The information on color and on the special equipment desired in each car is obtained from car orders placed by automobile dealers. By this scheduling program, cars of different colors and types follow each other down the assembly line—a light blue sedan may be followed by a beige station wagon.

Automobile Industry Occupations

An average of about 800,000 employees in hundreds of occupations were working in the automobile industry in 1956. Approximately 5 percent of the workers were employed in engineering, drafting, chemical, metallurgical, and other technical jobs; nearly 15 percent were in administrative, supervisory, and clerical positions. The rest of the automobile workers were employed in assembling, metalworking, inspecting, material handling, maintenance, and other plant occupations. The duties and training requirements of some of the important occupations are briefly described below.

Professional and Technical Occupations

The modern automobile is a product of the research, design, and developmental work of thousands of engineers, chemists, metallurgists, physicists, mathematicians, and other technical personnel employed by the automobile companies. Engineers make up the largest group of technical workers in the automobile industry. Automobile companies hire engineers with many different fields of specialization. For example, the automotive engineer designs, develops, or does research work on the automobile or chassis. The electrical engineer initiates changes to improve machine controls used in the manufacturing process. The mechanical engineer and the industrial engineer work on the problems of design of new machinery or on the layout of plant equipment. The industry also employs civil, chemical, safety, and sales engineers.

Although most of these professional workers are employed in research and development departments, some also supervise the more technical production jobs. For example, a metallurgist may be employed to supervise the melting operations in the precision casting and forging departments.

The industry employs many semiprofessional workers or technicians, such as draftsmen, engineering aids, laboratory assistants, and other technical aids to assist engineering and scientific workers. (A detailed discussion of the duties, training,

and general employment outlook for engineers, scientists, and technicians appears elsewhere in this Handbook. See index for page numbers.)

Administrative and Clerical Occupations

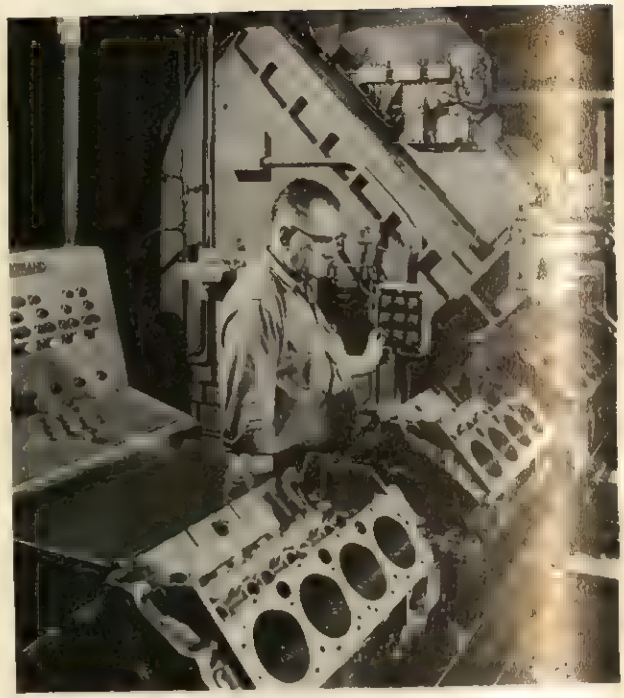
Many types of workers are employed in the industry to perform the many administrative functions needed to operate the automobile companies. Included in this group are executives, who determine how many vehicles to produce, what styles to make, what prices to charge, which parts the company should produce and which parts it should buy, and where best to locate plants. In the second level of administrative jobs are those such as personnel manager and purchasing agent, who direct individual departments or special phases of operations. Among those who assist the administrators are accountants, lawyers, market analysts, economists, statisticians, and industrial relations experts.

A large staff of clerical workers is also employed by the industry. Included are secretaries, stenographers, bookkeepers, clerks and typists, and business-machine operators. A large proportion of these office workers are women. (A detailed discussion of the duties, training, and general employment outlook for administrative and clerical workers appears elsewhere in this Handbook. See index for page numbers.)

Plant Occupations

The largest group of workers in the automobile industry (about 80 percent) is employed in factory jobs. Most of these workers make automobile parts, assemble them into the complete vehicles, and put the finishing touches on the cars and trucks. Other plant workers service and maintain the vast amount of machinery and equipment needed for automobile manufacturing.

After the engineers and draftsmen have planned and designed the new model car, the production process gets under way. First, the parts must be made. Parts are principally metal and are shaped by a variety of metalforming processes requiring workers in a number of metalworking occupations. For example, bodies must be stamped out by huge presses, cylinder blocks must be cast in foundries, crankshafts must be forged in forge shops, and pistons must be ground by machine tools.



Highly automatic machines are used in automobile en[illegible] production. Here one man operates a transfer machine which bores cylinders into engine blocks.

Machining Occupations. The modern automobile is a complex machine consisting of thousands of metal parts made to exact specifications. Many of these parts are manufactured to precise dimensions by machining workers. One of the largest metalworking occupations in the automobile industry is that of *machine-tool operator*. These workers operate power-driven machines (machine tools) which hold both the piece of metal to be cut and a cutting instrument, or "tool," and bring them together so that the metal can be cut, shaved, drilled, or ground. These workers are designated according to the type of machine tool they operate. Some of their job titles are *engine-lathe operator* (D. O. T. 4–78.011 and 6–78.011), *drill-press operator* (D. O. T. 6–78.081 through .084), and *milling-machine operator* (D. O. T. 4–78.031 and 6–78.031).

The most highly skilled machining workers are the *tool and die makers* (D. O. T. 4–76.010, .040, and .210). The automobile industry employed more than 20,000 of these skilled workers in mid-1956. Toolmakers make the jigs, fixtures, and other accessories that hold the work which is being machined. Diemakers construct the dies that are used in stamping, pressing, forging, and other metalforming operations. Tool and die makers read blueprints, set up and operate machine tools,

use precision measuring instruments, and make shop computations in their work. They must work to closer tolerance (more exact dimensions) and do more precision handwork than the other machining workers. (A detailed discussion of the duties, training, and general employment outlook for tool and die makers and other machining workers appears elsewhere in this Handbook. See index for page numbers.)

Foundry Occupations. Some parts of the automobile are made in foundry departments which make castings for such units as engine blocks. Castings are produced by pouring metal into molds where it cools and hardens in the shape of the molds. *Patternmakers* (D. O. T. 5–17.010 and .020) make a wood or metal pattern in the shape of the final casting desired. *Machine molders* (D. O. T. 4–81.050, 6–81.010, and .020) make the sand mold into which the metal is poured. *Coremakers* (D. O. T. 6–82.010, .020, and .030) shape the bodies of sand, or "cores," which are placed inside molds in order to form hollow spaces needed in castings.

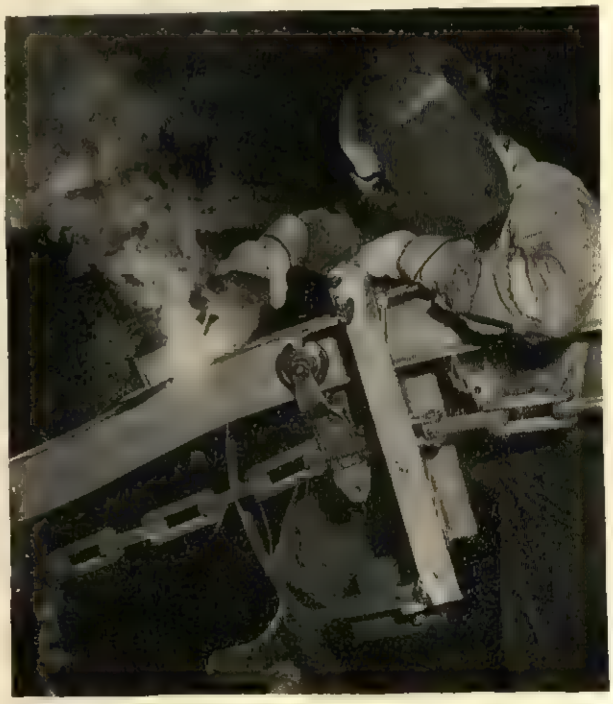
Many other workers are in less skilled occupations in the foundries. *Melters* (D. O. T. 4–91.447 and 6–82.310) operate furnaces used to melt metal for castings. The actual pouring is done by *pourers* (D. O. T. 6–91.612). After the casting cools, the *shakeout men* (D. O. T. 8–82.10) remove it from the mold. Other workers clean the castings and remove the excess metal. These jobs are usually learned in a few weeks of on-the-job training.

Forging Occupations. Some automobile parts, such as crankshafts and connecting rods which are required to withstand great stress, are shaped by forging hammers and presses in the forge shop. *Hammermen* (D. O. T. 4–86.110 and 6–86.110) operate drop hammers which pound metal into various shapes between closed dies. The hammermen are assisted by *heaters* (D. O. T. 4–88.081) who heat the metal stock in a furnace to prepare it for forging and then pass the stock to the hammermen. Other forge shop workers are engaged in cleaning, finishing, heat treating, or inspecting forgings.

Other Metalworking Occupations. The automobile industry employs large numbers of workers in other metalworking occupations. Included among these are *punch-press operators* (D. O. T. 6–88.600 through .649) who run power-driven presses which vary in size from small presses used for forming brackets, clips, or other small parts, to the massive presses which form, trim, and press holes in the doors and body panels.

Automobile plants also employ a considerable number of welders who operate welding equipment which is used to join metal parts. Welding can be performed manually or by machine. Some manual *electric-arc welders* (D. O. T. 4–85.020) and *gas welders* (D. O. T. 4–85.030) work in production jobs in parts and body manufacturing plants and others work in maintenance jobs repairing and rebuilding machinery and equipment. *Machine (resistance) welders* (D. O. T. 6–85.010, .020, .030, .060, and .100) are primarily employed on the assembly lines welding the separate parts of the bodies and subassemblies. (Detailed discussions of the duties, training, and general employment outlook for foundry, forging, and other metalworking occupations appear elsewhere in this Handbook. See index for page numbers.)

Assembling Occupations (D. O. T. 5–02.300 through .399, 5–25.570, 7–02.300 through .399, 9–02.01, and .81). The workers who do the assembling make up the largest occupational group in



Welder using metal arc welding to repair a wheel conveyor in an automobile plant.

Assemblers combine the parts of automobile power steering units on a subassembly line.

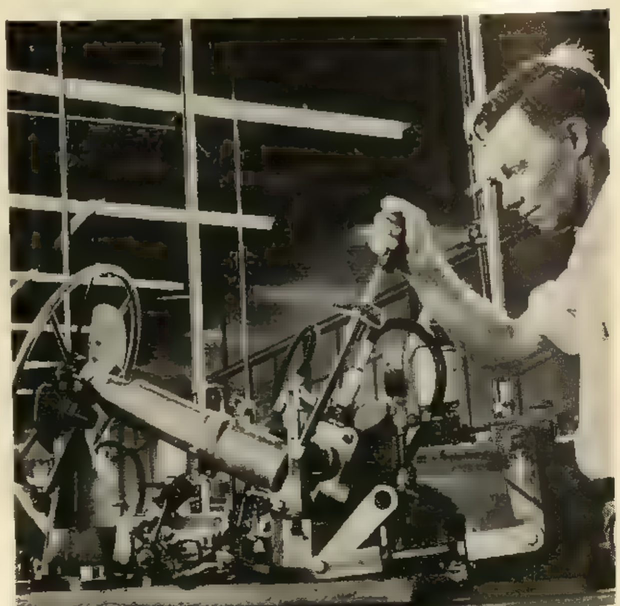
the automobile industry. In mid-1956, they represented approximately 15 percent of all the automobile workers. Assemblers may work on small units or subassemblies or they may assemble large units. Those employed on subassemblies may work in parts plants or on the subassembly lines of the larger automobile manufacturers. Line assemblers work on the final assembly line where they may bolt parts and subassemblies to make the completed car.

Most assembly jobs are repetitive and require little skill. Division of labor is carried to its extreme degree on the assembly line. For example, one worker may start nuts on bolts and the next worker may tighten the nuts with a power-driven tool called nut-runner. Each worker is assigned the amount of work he can do within the time it takes the automobile to pass his work station.

Inspection Occupations (D. O. T. 5–02.700 through .799, 7–02.700, 5–81.630, and 6–78.671). Automobiles can be produced on a mass basis because parts and assemblies for the same make of automobile are interchangeable. They are made to exact measurements and are subject to close quality control and inspection. In mid-1956, about 26,000 inspectors and testers were employed in the automobile industry.

Inspectors check raw materials when received, examine parts during the manufacturing stages, and make quality and conformity checks during the subassembly and assembly operations. Micrometers, specially designed gages, and other measuring and testing instruments are used by inspectors and testers in carrying out their duties.

Finishing Occupations. Many finishing operations must be performed before a car is completed. For example, the metal surfaces must be readied for finishing, the exteriors painted, the interiors covered, the seats upholstered, and finally, the finished product must undergo a thorough inspection. Among those employed in the finishing departments are metal finishers, platers, sprayers, polishers, sanders, trim cutters, sewing machine operators, and trimmers. *Metal finishers* (D. O. T. 6–77.040, .530 and 8–77.10) file and polish rough surface areas of metal parts in preparation for painting. *Platers* (D. O. T. 4–74.010) put a thin coat of metal on automobile bumpers and "hardware" for ornamentation and protection against corrosion. *Sprayers* (D. O. T. 7–16.210, .500 through .629) operate spray guns to apply paint or other finishes to the metal parts. *Polishers* (D. O. T. 6–77.020, .025, .060, .080, .330, and 9–02.01) rub the finished surfaces by hand or polish them with a portable motor-driven buffing wheel.



Inspector using precision instruments in final operational check of power steering units prior to shipment.

Several thousand women are employed as sewing machine operators to sew together fabric sections to be used in the interior of automobiles.

Cutters, sewing machine operators, and trimmers combine their skills to provide comfortable and attractive interiors. With hand shears or an electric knife, the *cutter* (D. O. T. 4–62.020 and 6–27.054) cuts fabric or leather to the specific shape according to a pattern. The *sewing-machine* operator (D. O. T. 6–27.503), using a power-driven machine, sews together the upholstery sections after they have been cut to size. *Trimmers* (D. O. T. 4–35.720) arrange and fasten springs and padding or foam rubber for the seats and backs, and tack the covering material in place.

Material Movement Occupations. The production of motor vehicles by the assembly-line process requires an elaborate system of material movement to supply the assembly lines and to remove finished products. A considerable number of workers are employed in moving materials in automobile and automobile parts plants. Some workers drive forklift trucks to deliver parts or subassemblies to the assembly line or to move materials between plants. *Material handlers* (D. O. T. 7–88.410 and 9–88.01) load and unload material from trucks or into and out of containers. *Crane operators* (D. O. T. 5–73.010, .020, .040 through .070) use machines to move raw steel stock, heavy dies, and other materials that are too heavy for material handlers to lift by hand.

Many workers are needed to keep the production workers supplied with tools, parts, and materials, and to keep records of materials. Factory clerks, such as *checkers* (D. O. T. 1–01.42 and 1–03.02), *stock chasers* (D. O. T. 1–18.65, .66 and 9–88.40), and *stock clerks* (D. O. T. 1–38.01 and .05), coordinate the delivery of parts to the proper location on the assembly line. They check, receive, and distribute materials and keep records of incoming and outgoing shipments.

Maintenance Occupations. A large staff is required to keep machines and equipment in good operating condition and to make changes in the layout of automobile plants. Because breakdowns in the assembly lines and in the highly mechanized machining line are particularly costly, the automobile industry employs many skilled maintenance employees to service this complicated production system. The maintenance and repair of complex electrical, electronic, and hydraulic equipment require well trained *electricians*, *electronic technicians*, and *machinery repairmen*. Automobile plants also employ many *millwrights* to move, install, and maintain heavy machinery and mechanical equipment. *Plumbers and pipe-*

Maintenance electrician checking control board wiring of a machine which controls a manufacturing process.

fitters lay out, install, and repair piping, valves, pumps, and compressors. Other maintenance workers employed in automobile plants include *carpenters* and *sheet metal workers.* (A detailed discussion of the duties, training, and general employment outlook for maintenance occupations appears elsewhere in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

The training requirements for jobs in the automobile industry range from a few days of on-the-job training to years of preparation. Many of the unskilled workers can learn their jobs with a day or two of training. On the other hand, the engineering and scientific jobs, as well as craft jobs, are filled by persons who have spent years in training for their occupations.

The automobile industry's emphasis upon new design and mechanical improvements has made it an important employer of persons with engineering and scientific backgrounds. The minimum requirement for engineering jobs is a bachelor of science or a bachelor of engineering degree from a recognized college. Advanced degrees are often required for scientists, particularly for those engaged in research and development work. Many of the companies give their newly hired engineers and scientists specialized training courses. It is from this group of professional workers that some companies have selected many of their top executives.

The requirements for other technical workers vary according to their specialties. For example, technical institute or junior college graduates are employed as engineering aids, laboratory assistants, and draftsmen. Some automobile companies train their own semiprofessional technical workers at company-run schools or subsidize students at local junior colleges or technical institutes.

Administrative positions are usually filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations or other specialized fields. Some companies have advanced training programs for workers in these specialties. Many of the top administrative jobs are filled by promotion from within the organization.

Most automobile firms hire persons who have had commercial courses in high schools or business schools for office jobs such as clerks, bookkeepers, stenographers, and typists. These workers have usually not been trained specifically for jobs in this industry.

The training requirements for factory jobs vary considerably. As noted earlier, many assembling jobs can be learned in a few days. However, workers with machine shop experience are sometimes chosen for the more skilled assembling jobs. Some of the less skilled machine tool operating jobs can be learned in a few months. The more skilled machine tool jobs require 1 or 2 years of on-the-job training.

The automobile industry hires thousands of workers for craft jobs which require extensive periods of training. Tool and die makers, patternmakers, electricians, millwrights, and machinery repairmen are some of the highly skilled workers who generally require at least 3 or 4 years of training before they can perform their specialized jobs. Although many of the workers in craft jobs have picked up the skills of their trade by working with experienced workers, most training authorities agree that apprenticeship training is the best way to learn a skilled trade. Automobile firms, in cooperation with labor unions, conduct apprenticeship programs for many of the skilled trades. The industry's apprenticeship program enables several thousands of young men each year to prepare themselves for skilled jobs such as machinists, millwrights, pipefitters, tool and die makers, patternmakers, maintenance electricians, and machinery repairmen.

Applicants for apprentice training are generally required to be between the ages of 18 and 26 (age limitations are waived for veterans) and graduates of a high school, trade, or vocational school. Training authorities stress that young persons interested in apprentice training should prepare themselves by taking courses in mathematics and other sciences. Apprentice applicants are given physical examinations, mechanical aptitude tests, and other qualifying tests.

Apprentice training includes both on-the-job training and classroom instruction related to the occupation. Mathematics, blueprint reading, shop theory, and specialized subjects are studied in the classroom while the operation and use of tools of a particular trade are learned in the shop.

The following example of a schedule of apprentice training for millwrights in the automo-

bile industry illustrates the type of training given in apprenticeship programs.

Shop training	*Hours*
Total	8,000
Dismantling, erecting machinery and equipment	1,500
Repairing and rebuilding pulleys, belting, conveyors, cranes, elevators, furnaces, shot blast, and related equipment such as cribs and scaffolds	2,000
Repairing and rebuilding conveyor drives, speed reducers (field work, reduction boxes)	500
Floor layout and installation of machinery, electric motors, and equipment (not including wiring)	1,300
Layout, fabrication, and erection of structural steel, plate steel, conveyors, and building beams	2,700

Related instruction

Shop arithmetic	Heat treatment
Blueprint fundamentals and machine shop blueprint reading	Hydraulic fundamentals
Algebra	Elementary pictorial drawing
Shop theory	D. C. fundamentals (Special)
Geometry	Effective speech
Elementary projection and dimensioning	A. C. fundamentals (Special)
Trigonometry	Job processes and plant layout
Characteristics of metals	Acetylene welding
Mechanical standards	Elementary strength of materials
Logarithms and slide rule	Arc welding
Elementary physics	

Most automobile companies select their foremen from among workers already employed. Frequently, persons who have completed apprentice training in a company are selected for supervisory jobs after they have acquired further experience. Applicants for foreman jobs go through a preliminary training period before they are eligible for promotion to the foreman level.

Employment Outlook

The automobile industry is expected to provide thousands of jobs for new workers in the late 1950's and the 1960's. During this period the number of workers employed in this industry is expected to rise significantly above the average level of employment in 1956 of about 800,000. Moreover, a large number of job openings will result from the need to replace workers who die, retire, or transfer to other fields of work.

From an industry which offered employment to only about 3,000 workers at the beginning of the 20th century, the automobile industry had, by 1956, become one of the Nation's largest employers. After a slow beginning, during which time the automobile was being established as the basic form of transportation in this country, the industry's employment of plant workers reached a high of 471,000 by 1929. During the depression the industry's employment was greatly affected. Until World War II, with the exception of 1937, it failed to equal the high point of the twenties. The industry did not produce for the civilian market during World War II and at the conclusion of the war there was an unprecedented demand for its products. Employment expanded sharply as the industry attempted to meet the accumulated demand for motor vehicles; from 1946 through 1950 the employment of production workers increased almost 30 percent. Employment expanded during the Korean hostilities when automobile plants produced increasing amounts of defense items as well as motor vehicles and parts. Since the end of the Korean conflict employment in this industry has shown marked fluctuations because of the changing demand for automobiles.

Despite the rather sharp fluctuations of employment, which have been characteristic of this industry in recent years, the long-term trend of employment has been upward. Thus, despite wide swings of employment, this industry has provided, on the average, more jobs than any other American manufacturing industry in the post-World War II period.

An analysis of the factors affecting future production and employment levels in this industry indicates a long-range upward trend in employment. The primary factor affecting employment is the demand for automobiles. Demand is in turn affected by such factors as the level of economic activity, the level of income and its distribution among income groups, the growth of population and household formation, the move to the suburbs, and the growth of multiple car ownership. Another important element in the demand for motor vehicles is the total number of cars, trucks, or buses in use, because a certain percentage of new vehicles are needed each year to replace those being scrapped. During a period of economic expansion or automotive design innovation, the volume of scrappage ordinarily increases as total registration increases. An examination of the above elements influencing the sale of automobiles indicates a continued increase in the number of vehicles produced.

Employment in this industry is also affected by the defense activities of automobile manufacturers. Although it is difficult to make any long-range projections of defense expenditures because appropriations for military equipment are influenced by international conditions, it appears likely that part of the automobile industry's expected increasing employment in the next decade will be due to its growing participation in defense activities.

Employment probably will not increase as fast as production. The primary reason for the difference in the rates of growth is related to the industry's emphasis upon mechanized production methods and automatic assembly operations which are expected to continue to result in increased output per worker. Planned expenditures for new plants and equipment are also expected to lead to improved efficiency in production which would reduce the labor requirements of the automobile industry. On the other hand, the trend toward bigger and heavier cars, the addition of new or improved equipment in motor vehicles, and constant style changes could, to some extent, offset the effect of increased productivity. The introduction of power steering, automatic transmissions, and air conditioners are recent examples of equipment changes which tend to offset reduced manufacturing man-hour requirements. The industry's need for additional workers would also be increased by a shortened workweek.

The rates of growth of the different occupational groups will vary as a result of both the industry's emphasis upon research and development and its increasing dependence upon automatic manufacturing operations. For example, the number of engineers, scientists, and other technical personnel is expected to increase at a faster rate than many other occupational groups because of the anticipated expansion of research and development activities. The employment of skilled workers such as tool and die makers, millwrights, pipefitters, machinery repairmen, and electricians who produce, install, or maintain the equipment used in automatic manufacturing processes will also grow at a relatively faster rate than other occupational groups in the 1956–66 decade. The less skilled workers, such as assemblers, will probably increase at a slower rate than total employment. Clerical and administrative workers are expected to increase at a somewhat faster rate than production workers as a whole. There will be a growing need for stenographers, typists, business machine operators, and accountants.

In addition to job opportunities arising from the growth of the industry, thousands of employees will be needed to replace those workers who die, retire, or transfer to other fields of work. Deaths and retirements alone will create about 14,000 to 17,000 job openings annually on the average during the 1956–66 decade.

Earnings and Working Conditions

Earnings in the automobile industry vary considerably because of the industry's wide range of occupations and levels of skills. The earnings of production workers in this industry are generally higher than those in other manufacturing industries. In December 1956, production workers employed in the automobile industry earned, on the average, $113.90 a week and $2.52 an hour. This compares with the average earnings of $84.05 a week and $2.05 an hour for production workers in all manufacturing industries in the same month. The minimum hourly entrance rate in automobile plants in the Detroit area in September 1956 ranged from $1.83 to $1.88. Recent earnings data for individual occupations in the automobile industry are not available. However, pay scales of automobile firms compare favorably with industry generally.

Most employees in the industry receive benefits such as life insurance, accidental death and dismemberment benefits, weekly accident and sickness benefits for temporary disability, and hospitalization, surgical, and medical benefits. These are typically financed jointly by employers and employees. Most workers are also covered by supplemental unemployment benefit plans (paid for solely by the employers) which provide cash payments ranging from $2 to $25 a week for the maximum of 26 continuous weeks of unemployment to all hourly rated employees with at least 1 year of service. These benefits are in addition to those received from State unemployment compensation plans. In 1956, most workers received paid vacations ranging from 1 to 3 weeks.

A great majority of the automobile workers are also covered by pension programs, almost all of which are paid for entirely by the employer. Retirement benefits vary with length of service. In a typical case, a retiring employee, age 65, with 30 years' service, receives a monthly company

pension of $67.50 in addition to his Federal social security benefits.

The great bulk of the workers in the vehicle assembly plants belong to the International Union, United Automobile, Aircraft & Agricultural Implement Workers of America. The International Union, Allied Industrial Workers of America is the bargaining agent for employees in some automobile parts plants. Other unions with membership in the automobile industry include the International Association of Machinists; the Pattern Makers' League of North America; the International Molders and Foundry Workers Union of North America; the Metal Polishers, Buffers, Platers and Helpers International Union; and the Mechanics Educational Society of America.

In general, the work surroundings in automobile plants are more favorable than those in most types of metalworking facilities. Most of the places in which automobile workers are employed are relatively clean and free from dust, smoke, and fumes. However, some work surroundings, particularly in the foundry and forge departments, may be hot and the worker may be exposed to noise, dust, and fumes. In recent years, the working conditions in foundries and forge departments have been greatly improved by the introduction of larger and better ventilation systems.

Automobile plants on the whole are comparatively safe places to work, although safety conditions vary somewhat among the individual departments or facilities. In 1955, the average number of disabling injuries in the automobile industry was 5.1 for each million employee hours worked compared with an average of 12.1 for all manufacturing industries.

BANKING OCCUPATIONS

Banks and Their Employees

Most cities and towns in the United States have one or more banks, which together employ more than half a million people. Nearly all businessmen and the majority of other adult citizens use banking services to earn interest on their money; to insure its safekeeping; to pay bills more conveniently; and/or to finance projects. Banks also perform many other functions, including administration of estates and trusts, analysis and handling of securities, and foreign banking. The complicated financial transactions of our present-day business world could not be carried on without the services of banks.

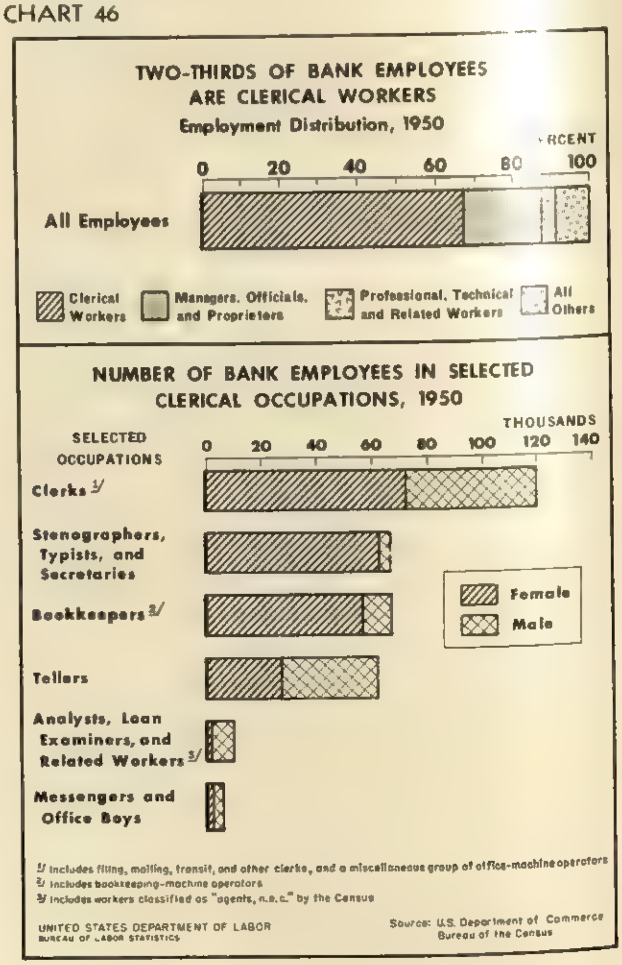
Nature of the Banking Business

Though several types of banks are found in most cities today, the commercial banks, which offer the most varied services, lead in number of establishments and employees. Nearly 14,000 such banks, with approximately 7,000 branches, were operating at the beginning of 1956. Together, these 21,000 banking offices employed nearly half a million workers, about half of whom were women. Other types of banks may also offer some of the services of commercial banks. For example, although the main purpose of mutual savings banks is to handle savings deposit accounts, they may also furnish safe deposit facilities and administer trusts.

Many other financial institutions use workers with the same occupational skills required in banks. Among these institutions are savings and loan associations, which usually invest customers' funds in first mortgage loans made on real estate; personal finance companies, which specialize in consumer credit; and investment banking organizations which are concerned with the underwriting, buying, and selling of corporation stocks and bonds and municipal bonds. Some governmental or government-related agencies also have positions of a banking nature; among these are the housing and farm financing agencies, the Export-Import Bank, the Federal Deposit Insurance Corporation, and the Federal Reserve System. Federal Reserve Banks, operating as bankers' banks in 12 districts, had nearly 20,000 employees in 1955. The Federal and State agencies concerned with the supervision of banks employed about 3,000 persons as bank examiners in 1955.

Banking involves a mammoth clerical operation. Approximately two-thirds of all bank employees are clerical workers who handle checks and deposits, keep records of transactions, and take care of correspondence, telephone calls, and other office duties. (See chart 46.) The Nation's commercial banks have approximately 100 million depositors, who write an average of 32 million checks daily. One of the largest groups of bank clerks is engaged in sorting, recording, adding,

CHART 46



subtracting, filing, mailing, and other clerical operations relating to these checks. Many of these clerks operate office machines, such as adding or calculating machines, which are used in many types of offices; others operate proof machines, computers, and other machines designed especially for banks. Two other large groups of clerical employees are the bookkeepers, and the secretaries, stenographers, and typists; each of these groups numbered approximately 67,000 in 1950. The skills of these workers are, of course, the same as those required for similar work in other industries. (See statements on bookkeepers, p. 204 and on secretaries, stenographers, and typists, p. 205.) Tellers are another numerically important group in banking (62,000 in 1950). Other workers in the clerical group include credit analysts, loan examiners, telephone operators, and messengers.

Bank officers—presidents, vice presidents, treasurers, comptrollers, cashiers, and assistants—are the people directly responsible for the management of banks. Officers account for about one-fifth of all bank employment. (See chart 46.) Other bank employees include various professional specialists, such as accountants, lawyers, statisticians, economists, and engineers (see index for page numbers of statements on these occupations) who may be employed full or part time to prepare reports, give expert advice, and conduct research.

Where Employed

Banks are found in communities of all sizes, but employment is concentrated to some extent in heavily populated areas. Approximately 40 percent of the employees of insured commercial banks are in New York, California, Pennsylvania, and Illinois. Far more bank employees are located in New York City, the financial capital of the world, than in any other city. The more than 500 mutual savings banks operate primarily in the Northeastern States.

Employment is also concentrated in the largest banks. In 1955, nearly half of all bank workers were employed by the 235 largest institutions, which represented less than 2 percent of all insured commercial banks. These large banks each had $100 million or more in deposits and, on the average, each employed more than 1,000 employees. In contrast, the smallest banks, each with less than $5 million in deposits, averaged only 8 employees per bank. These small banks represented nearly 70 percent of all insured commercial banks.

Employment Outlook

Job opportunities in banks are expected to be numerous for the remainder of the 1950's. Most openings will be in clerical occupations, which are filled mainly by women. In these occupations, as in others employing large numbers of women, many vacancies arise as women leave to marry or for other reasons. The American Bankers Association estimated that the rate of turnover (the proportion of jobs that become vacant during the year) was about 25 percent in 1955. If this rate continues, more than 100,000 employees will be needed each year as replacements. In addition, some people will be hired to fill new positions.

Employment in banks has increased steadily over a long period, but the greatest expansion has occurred in the last 15 years. The total number of bank employees rose by about 75 percent from 1941 to 1956; commercial banks, the largest employers, added about 15,000 new jobs annually, on the average, during this period. Major factors responsible for the expansion of bank employment have been the rising levels of production, sales, and income in this country and the resulting extensive use of bank services by businessmen and consumers. As population and income have grown, banks have also expanded their services—especially those, such as small loans and economy checking accounts, for people with moderate incomes. With greater use of bank facilities, the number of checks written will probably continue to rise. It has been estimated that, if past trends persist, 14 billion checks (double the number in 1950) may be written in the year 1960.

Most of the job openings created by the growth in banking business or by turnover will continue to arise in large city banks, which account for the bulk of bank employment. However, branch banks will offer many opportunities in less populated areas. Branch banking—which has increased steadily since the midthirties—will continue to expand as people move to suburban areas of large cities and new business centers are established to serve the smaller communities.

More jobs will also arise as established banks expand their services to old customers and seek new business. Banks will probably continue to

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build "auto bank" branches and "drive-up" facilities to help customers with parking problems. Pension funds, especially the growing number established under union-management agreements, are a source of new business for bank trust and investment services. Development credit corporations, to which banks and other financial institutions supply funds for loans to businessmen and others, are active in New England and may spread to other regions.

The major growth factors already discussed point to continuing increase and stability of banking employment, as long as economic conditions remain favorable. Employment growth may be limited to some extent in the long run by the use of additional and improved automatic office equipment. However, after some allowance is made for displacement of clerical workers by machines, it is likely that total banking employment will be greater in 1965 than in 1955. The effect of new office-machine developments, particularly the use of electronic computers, will vary from one occupation to another, as discussed in the statements on specific occupations in banking which follow this section on the banking industry as a whole.

Besides looking forward to continued long-term growth in their industry, bank employees can anticipate greater stability of employment than workers in many other fields. In general, they have been less affected by layoffs during declines in the general level of business activity than workers in some other industries. Since individual bank deposits are insured up to $10,000, it is unlikely that there could be a recurrence of mass closings of insolvent banks such as occurred in the early 1930's. Employees are not likely to lose their jobs when banks are sold, merged, or consolidated, as these establishments usually continue to do business as branch banks. If bank employers have to curtail employment for various reasons, they can usually do so by not replacing employees who die, retire, or quit their jobs for other reasons, thus reducing the number of openings for new employees, but minimizing layoffs of experienced personnel.

Earnings and Working Conditions

Clerical workers in many beginning jobs (file clerks, office boys or girls, etc.) in banks and related businesses had average weekly earnings ranging from $37 to $54 in large cities in 1955–56. (See table.) Typists in entry jobs generally earned between approximately $45 and slightly more than

Average weekly earnings for selected office occupations in finance, insurance, and real estate, September 1955–April 1956 [1]

Occupation and grade	Northeast			South		Middle West				Far West	
	Newark–Jersey City	New York City	Philadelphia	Atlanta	Dallas	Chicago	Detroit	Minneapolis–St. Paul	St. Louis	Los Angeles–Long Beach	San Francisco–Oakland
Men											
Clerks, accounting, class A	$79.50	$78.50	$77.50	$79.50	$71.00	$83.50				$76.00	
Office boys	44.00	46.00	37.50	43.00	42.50	52.50	$43.50			49.00	$51.50
Tabulating-machine operators		65.50	59.00	60.50	64.50	73.50		$64.00		77.50	70.50
Women											
Bookkeeping-machine operators, class B [2]	50.00	57.00	46.50	50.50	49.50	59.50	54.00	46.50	$46.00	53.50	54.50
Clerks:											
Accounting, class A	61.00	72.00	57.50	60.00	51.50	72.00	69.00	66.00		67.50	68.00
Accounting, class B [2]	56.00	56.50	47.00	47.00	47.50	58.00	53.50		47.50	54.00	56.00
File, class A	53.50	61.00	50.50	52.50	47.00	61.00	60.50		54.00	55.50	61.50
File, class B [2]	44.00	47.00	39.00	41.50	38.50	48.50	47.50	42.50	43.00	45.00	46.50
Payroll		71.50	58.50		58.50	70.50				68.00	69.50
Comptometer operators		62.00	47.50		53.00	61.00	57.50				56.00
Key-punch operators	58.00	55.50	48.50	47.50	45.50	61.00	57.50	48.00	52.50	59.50	58.50
Office girls	41.00	46.00	37.00	44.00	39.00	49.50	46.00	40.00		46.00	49.50
Secretaries	73.00	78.00	63.50	65.50	69.00	70.00	72.00	68.00	62.50	74.00	74.50
Stenographers, general	55.50	60.50	50.00	56.00	54.50	63.50	63.50	53.00	54.00	63.50	65.00
Switchboard operators	56.00	62.00	50.50	56.00	57.00	64.50	58.00	55.00	50.50	56.00	62.50
Switchboard operator–receptionists	60.00	59.00		45.50	52.50	57.00				59.00	60.50
Tabulating-machine operators		66.00	55.50	52.50				54.00		73.00	67.00
Transcribing-machine operators, general	53.00	59.50	46.50	52.00	49.00	62.50		52.50		57.50	62.00
Typists, class A	54.00	57.50	50.00	49.50	51.00	62.00		50.00		55.50	59.00
Typists, class B [2]	47.00	51.00	42.00	44.50	42.50	54.00	49.00	44.50	45.00	51.00	51.50

[1] Earnings relate to standard salaries that are paid for standard work schedules.
[2] Class B occupations, which are of a more routine nature and involve less responsibility than class A occupations, are the most likely assignment for inexperienced employees.

SOURCE: Wages and Related Benefits, 17 Labor Markets, 1955–1956. BLS Bull. 1188, 1956.

$50. File clerks averaged less than typists, but beginning accounting clerks and bookkeeping-machine operators averaged somewhat more.

In general, the highest pay for women employees in finance and related industries (including banks) was in the Chicago, San Francisco–Oakland, and New York City areas, where average earnings ranged from $46 weekly for office girls to $78 for secretaries in 1955–56. Tellers (not included in table), who are experienced bank employees, are among the highest paid employees in nonsupervisory jobs. In most banks, the salary of an employee is increased every year for a number of years, if on-the-job performance is satisfactory. Generally, women received lower salaries than men in the same job classification.

College graduates, hired as executive trainees in early 1956, received annual salaries ranging from $3,000 to $3,600 in small banks, and higher salaries in large city banks. Junior officers in large banks may earn, after 10 or 15 years of banking experience, more than double the salaries of trainees. Very large banks often have a group of vice presidents whose salaries range from $15,000 to $30,000 annually, although some senior vice presidents earn more than triple these amounts.

Salaries of both clerical workers and officers are usually highest in large banks. In 1955, average salaries of employees (excluding officers) working in the smallest commercial banks were approximately half those of employees in the largest banks. Officers in the largest banks may have average salaries from 2 to 3 times greater than those in the smallest organizations. These differences are due to the greater responsibilities and more specialized nature of executive work in larger banks and to the fact that large banks are usually located in large cities where salary rates reflect the higher living expenses. In small towns, bank officers often have greater opportunity to supplement their incomes from sources such as insurance or real estate commissions.

In large cities, most employees in finance and related industries (banking, insurance, and real estate) work slightly less than the 40-hour week customary in many industries. In small banks, daily hours may be irregular. In many banks, tellers and some other employees may work late hours at least once a week, and accounting department employees may work overtime during end-of-month peak periods.

Banks are noted for their liberal provisions for holidays. Eleven or more paid holidays are common for employees in Northeastern States. In contrast, manufacturing industries usually provide only 6 or 7 paid holidays annually. A 2-week vacation after 1 year's service is given by most banks. A number of banks allow a 3-week vacation after 10 or 15 years' service and 4 weeks after 20 or 25 years. Life insurance and hospitalization and surgical plans are benefits usually granted banking employees. Retirement plans, frequently financed by employer and employee contributions, are also common in banking.

Work in banks is generally carried on in clean, well-lighted, and often air-conditioned office space. In larger banks, most clerical employees work in offices not in the public view. Most clerical work in banks requires no strenuous physical exertion, and a number of jobs can be performed by moving about in a limited work area. This affords some opportunities for older men and women and for those with certain physical handicaps.

Where To Go for More Information

Information on jobs in banking may be obtained from your local bank and your State bankers association. General information on banking occupations is available from:

American Bankers Association,
12 East 36th St., New York 16, N. Y.

Information on in-service educational opportunities for bank employees is available from:

American Institute of Banking,
12 East 36th St., New York 16, N. Y.

Information on investment banking may be obtained from:

Investment Bankers Association of America,
425 13th St. NW., Washington 4, D. C.

For further information on the nature of banking as a field of work see:

Employment Outlook in Banking Occupations,
Bureau of Labor Statistics Bull. 1156, 1953.
Superintendent of Documents, Washington 25, D. C.
Price, 30 cents.

Bank Clerks and Related Workers

Nature of Work

Well over 180,000 employees in banks are clerks, bookkeepers, or office-machine operators, and at least 5,000 are employed primarily as messengers. The exact duties performed by these workers vary with the size of the bank and the nature of its business. Clerks in large banks are likely to have a few fairly well-defined duties. In small banks, they may work at combination jobs such as messenger-clerk or proof-machine-bookkeeping-machine operator, or they may serve as general clerks who file material, operate the switchboard, give routine information to the public, operate duplicating or other office machines, and help with sorting and listing of checks and other items.

A *bookkeeping clerk* (D. O. T. 1–01.02 and .03) may cancel and file checks, sort and list various items, and alphabetize material for experienced bookkeepers. A *transit clerk* (D. O. T. 1–01.43; 1–06.21 and .22; 1–06.24) sorts checks and drafts on out-of-town banks according to routing instructions, lists sorted items on cash letters, and mails checks and cash letters for collection purposes. A *mortgage clerk* (D. O. T. 1–37.34) may type legal papers affecting title to real estate, record the transaction, and maintain a record card file.

Clerks operating proof machines in a bank

Some of the office machines commonly used in banks are adding machines, proof (sorting) machines, and bookkeeping machines. Most check sorting is done by *proof-machine operators* (D. O. T. 1–25.68). The proof machines have sort keys and adding-machine keys which sort checks and record amounts involved in one operation. Proof-machine operators may also help prepare monthly statements of customers' accounts for mailing.

Bookkeeping-machine operators (D. O. T. 1–02.01 to .03) are responsible for maintaining records of customers' accounts. The proof department forwards deposit slips and paid checks to the bookkeeping-machine operator who arranges them in their proper order. Then, using the bookkeeping machine, the operator adds deposits and subtracts withdrawals from customers' accounts, usually kept on statement cards. The bookkeeping-machine operator may also cancel and file checks, give information about accounts by telephone, and prepare customers' statements for mailing. In many banks, the title of bookkeeper is assigned to these workers and, in some cases, to bookkeeping clerks as well. Very few hand bookkeepers (ledger-type) are employed in banks nowadays.

In larger banks where many records may be kept on punch cards, clerks are employed as *keypunch operators* (D. O. T. 1–25.62) and *tabulating-machine operators* (D. O. T. 1–25.64). Operation of a microfilm machine to maintain photographic records of checks may also be a separate job in some banks. One or more clerks may also operate multilith, mimeograph, or addressograph machines (D. O. T. 1–25.22 to .26; .41).

Bank messengers (D. O. T. 1–06.27) are responsible for the safe delivery of banking items such as checks, drafts, and letters. They make trips to other banks, branches of the same bank, business firms, and often government agencies in the local area. Messengers in many banks are older men who, although still active, can do only light work. *Inside messengers* (D. O. T. 1–23.14) or

pages, who may be men or women, run errands within the bank and may also do simple clerical tasks.

Training and Other Qualifications

High school graduation is adequate preparation for most clerical entry jobs in banks. For the majority of jobs, business education courses such as bookkeeping, shorthand, typing, and business arithmetic are considered desirable. In addition, since bookkeeping, adding, and calculating machines are widely used in banks, courses in machine operation are helpful. Before an applicant is hired, he is usually given a personal interview by at least one bank official and may be given an intelligence test and a clerical aptitude test—the latter to determine his speed and accuracy. Employers usually give favorable consideration to young people who have worked in a school bank or held a part-time bank job.

Young men and women without previous experience may be hired for many of the jobs already mentioned, such as file clerk, bookkeeping clerk, and transit clerk. Usually banks train employees in the operation of office machines, such as proof or bookkeeping machines, designed especially for local bank needs. Whereas most new employees were formerly hired as messengers, now only a limited number of beginners are assigned to such work.

Promotion from a routine clerical job may be to a minor supervisory position, to teller or analyst, and then to a senior supervisory position. Some opportunities for advancement to bank officer also exist for outstanding candidates, although an increasing number of banks give preference to persons with college training in selecting officers. Additional education, particularly, the completion of courses offered by the American Institute of Banking, may be a factor affecting promotion. Length of service is also an important factor in advancement, since most banks follow a "promotion-from-within" policy. These factors, together with a person's ability and leadership qualities, usually determine appointment to more responsible positions.

Employment Outlook

Openings for clerical workers in banks are expected to be numerous throughout the remainder of the 1950 decade. A number of jobs will be provided in new branch banks, which will be opened as the population continues to shift to suburban areas of large cities, as well as in long-established banks that expand their services. In addition, a greater number of job openings will arise as a result of high turnover rates—common in occupations where women comprise a major proportion of the work force. The supply of persons to fill these jobs, obtained chiefly from the 18- to 21-year age group—will remain relatively low during the late 1950's.

As the banking industry continues to expand in the 1960's, clerical employment is expected to increase somewhat. (See general employment outlook section on p. 433.) However, an important factor that must be considered is the effect the introduction of additional automatic office equipment will have on clerical employment in the long run. Over the years, banks have been using an ever increasing number of machines, such as bookkeeping and calculating machines, and still have continued to expand their employment. Nevertheless, it is undoubtedly true that many more clerical workers would have been hired had such machines not been available. New machines—especially electronic computers, already in use in a few banks in 1956—have displaced some clerical workers formerly engaged either in manual handling of checks and similar items, or in computing and recording bank transactions. One large electronic bookkeeping machine, with a few operators, can handle many thousands of entries and withdrawals in customer accounts, automatically calculate service charges, and print a completed monthly statement ready for mailing. However, such equipment is expensive and only city banks with a great volume of business can afford to install the large machines. On the other hand, less expensive electronic computers are becoming available for use in smaller banks. These developments will reduce employment mainly in routine clerical jobs, such as filing, sorting, and operating calculating and bookkeeping machines. They will also create a smaller number of new jobs, some of them involving higher skill and better pay.

(See introductory section of this chapter for information on *Where Employed*, *Earnings and Working Conditions*, and *Where To Go for More Information*.)

Tellers

(D. O. T. 1–06.02 to .04)

Nature of Work

Tellers deal directly with the public more frequently than other bank employees. Each bank employs one or more tellers whose chief duties are to receive deposits, handle withdrawals, and make change for customers. More than 60,000 tellers are employed in banks of all types. (See chart 46.)

Paying and receiving tellers—by far the largest group and the one with whom most people have contact—begin their work on a typical day by obtaining their individual cash boxes from the vault. If the teller believes more money will be needed in the course of a day's work, he orders more coin and currency. During banking hours for the public, the teller is mainly occupied with cashing customers' checks and handling deposits and withdrawals. Before a check is cashed, he must verify the signature or endorsement and be certain that account balances are adequate for payment. Approval is usually obtained from the head teller or an officer when checks for large amounts are presented. In handling deposits, the teller must usually compare deposit slips with the amounts tendered and make entries in a pass book or on deposit receipts.

After public banking hours, the paying and receiving teller "proves" his cash. He usually counts the cash on hand, lists the currency-received tickets on a settlement sheet, makes any necessary adjustments, and takes the settlement sheet to the proof department. Such tellers may perform other incidental tasks such as counting deposit slip items for analysis purposes, filing new account cards, and removing closed-account cards from files. They may supervise one or more clerks assigned to assist them.

Many other kinds of tellers are employed, particularly in large banks. These tellers are usually identified by the department to which they are assigned or the kind of financial papers which they handle. For example, trust tellers receive and issue receipts for the payment of promissory notes and discount tellers perform clerical work connected with the issuance and collection of customers' notes.

An increasing proportion of tellers in banks are women

Training and Other Qualifications

Teller positions are usually filled by experienced clerical workers as a result of the "promotion-from-within" policy followed by most banks. Seniority, coupled with ability proven in related clerical jobs, affects chances for promotion to teller positions.

Since much of the teller's work involves contact with the public, personal characteristics such as neatness of appearance, courtesy, tact, and a friendly and pleasant manner are important. Many customers rate a bank's services principally by the impression they receive from their dealings with tellers. Since tellers are responsible for initiating changes in customers' accounts, accuracy as well as speed is important in their work.

Tellers who perform ably for a number of years may be promoted to head teller or to some other senior supervisory position. They may also qualify eventually for a bank-officer position, particularly if they have had college training.

Employment Outlook

Additional tellers will be needed in the late 1950's and over the long run to service the growing population and to take care of the expected expansion in the volume of bank transactions. The trend toward establishment of more branch banks will provide additional opportunities for tellers. Although use of mechanical equipment to speed

up tellers' duties will probably be extended, the use of new machines is not expected to affect employment of tellers as much as that of many other types of clerical workers.

Opportunities for women to advance to teller positions have improved greatly since the beginning of World War II. About half of all bank tellers are women, and opportunities for women clerks to advance to teller positions will continue to be numerous.

(See introductory section of this chapter for information on *Where Employed*, *Earnings and Working Conditions*, and *Where To Go for More Information*.)

Bank Officers

(D. O. T. 0–85.10; 0–97.01 to .05, .14; 0–98.01 to .06, .08, .11, .12, .13)

Nature of Work

Nearly a fifth (about 90,000) of all bank employees are officers. The number of officers in a bank and their titles and responsibilities depend upon the size of the bank and the particular services offered. In a large bank, departments such as trust, credit, investments, and real estate may each be supervised by an assistant officer. These officers in turn may be responsible to a senior officer—vice president, treasurer, comptroller or cashier—in charge of several departments. The bank president exercises general supervision over all operations. Some small banks or branches are run almost entirely by the cashier or a vice president acting as manager. It should be noted that unlike cashiers in other businesses, who make change and count cash, the cashier in a bank is the executive officer generally responsible for bank funds.

A bank officer makes decisions within the framework of policy as set by the board of directors. A broad knowledge of business activities is required, which must be related to the operations of the particular department involved. For example, the loan officer must exercise his best judgment in approving loans, bearing in mind general business conditions and the local community situation. He must carefully evaluate the reports of credit analysts (usually executive trainees) on the individual or business firm applying for a loan and balance the favorable and unfavorable elements in reaching a decision. Similarly, the trust officer must have a thorough understanding of a particular trust agreement, in order to manage properly a fund or estate. Only the wise investment of trust funds will enable fulfillment of a trust agreement, such as provision for sending a young person to college or paying pensions to employees of a business enterprise. Besides supervising financial services, these and other bank officers are frequently called upon to give advice to individuals and businessmen and to participate in community projects.

Training and Other Qualifications

Employers in banks have, in recent years, shown a marked preference for college graduates in selecting persons to be trained for officer positions. Outstanding individuals with experience in banking are sometimes considered for executive trainee jobs, however, even if they have only a high school education.

Specialized college education is seldom required for executive trainee positions. However, a business administration curriculum with a major in banking is excellent preparation; other helpful majors are accounting, finance, or statistics. A liberal arts curriculum with some courses in the fields mentioned and in economics, political science, and commercial law, is usually considered good preparation. Courses in English composition are also desirable.

In-service training aimed at developing future bank officers is given in most banks. Programs are generally designed to give a trainee the "feel" of banking and to help bank officers determine the position for which the employee is best suited in the long run. Clearly defined training programs, which may vary in length from 6 months to 2 years, prevail in large city banks. Trainees may work as credit or investment analysts, or be rotated among various clerical jobs in several bank departments. Assignments to teller positions may be made in smaller banks. In other programs, trainees study, observe, and write reports on departmental operations. Though many small banks

cannot operate formal officer-trainee programs, they usually attempt to offer some plan whereby promising employees can gain enough understanding of various banking operations to qualify for later advancement.

Advancement to officer positions may come slowly in small town banks, which are often operated largely as family enterprises and in which little turnover occurs. In large city banks with special training programs, initial promotions may come more quickly. However, many years of service are usually required to obtain the thorough knowledge of bank operation, bank customers, and the community needed to qualify for senior officer positions.

Although experience, ability, and leadership qualities receive great emphasis when promotions are made, advancement may also be accelerated by special study. Courses in every phase of banking are offered by the American Institute of Banking, a long-established, industry-sponsored school. The courses are usually offered locally and most banks pay tuition fees after employees successfully complete their courses. More advanced training is offered in graduate schools of some universities—one of the better known is the Graduate School of Banking conducted each summer at Rutgers University by the American Bankers Association. Similar school sessions are sponsored by State bankers associations.

Employment Outlook

College graduates who meet the standards for executive trainees in banks will probably continue to be in demand during the remainder of the 1950's and the early 1960's. A number of new positions will probably arise from the expected overall expansion of banking discussed in the introductory section of this chapter. Additional junior officers may also be needed as the use of electronic computers becomes widespread, and more program planning and action is required owing to the speedier flow of complicated reports. However, the greatest source of openings for officers will continue to result from turnover. The American Bankers Association estimates that normal replacement needs (from death, retirement, and resignation) require about 5,000 new officers each year. However, competition for promotion will probably remain keen, particularly in the largest banks.

Opportunities for women have improved in recent years and the outlook is favorable for continuation of this trend. Women bank officers were a rarity in the 1920's, but in 1955, more than 9 percent of all bank officers were women. Most of the women were employed as assistant cashiers.

(See introductory section of this chapter for information on *Where Employed*, *Earnings and Working Conditions*, and *Where To Go for More Information.*)

DEPARTMENT STORE OCCUPATIONS

Department Stores and Their Workers

People who shop in department stores—for goods which may range from pins to prefabricated houses—come into contact chiefly with the sales personnel. Salesmen and saleswomen represent about half of all department store workers. However, these stores also need hundreds of other types of employees—for example, buyers, personnel workers, stenographers, porters, elevator operators, and deliverymen—to carry on their large and complicated businesses.

Altogether, the country's 2,700 department stores employed more than 800,000 people in 1955. Of the 70 different types of retail businesses, the only ones which employed more workers than this were food stores and eating and drinking places. Department stores are important sources of employment in all major cities and many suburban areas. Their business is so great that the dollar volume of their sales is recognized as an important indicator of the Nation's economic health.

Nature and Location of Department Store Business

Department stores are distinguished from other retail stores by their large size and the enormous variety of their merchandise. In their many different departments, all located under the same roof, customers can buy apparel, furniture, homefurnishings, electrical appliances, toys, and countless other items. "Bargain basements" are generally considered another unique feature of many department stores.

These stores also offer customers a variety of services, including various forms of credit, free delivery of purchases, gift wrapping, and telephone and mail-order service. Many have facilities such as beauty parlors, watch and jewelry repair shops, restaurants, and, in some cases, even small post offices. Frequently, specialists are employed to advise customers on such matters as planning of parties, weddings, or home decorating.

The largest department stores are giant establishments with several thousand employees each. However, the business also includes stores with as few as 25 employees.

A growing proportion of department stores are members of chain organizations. Some belong to regional or national chains which may include 100 or more stores. In addition, a few mail-order companies operate large numbers of department stores. A growing number of department stores, including independently operated stores as well as members of chain organizations, operate branch store outlets in suburban areas.

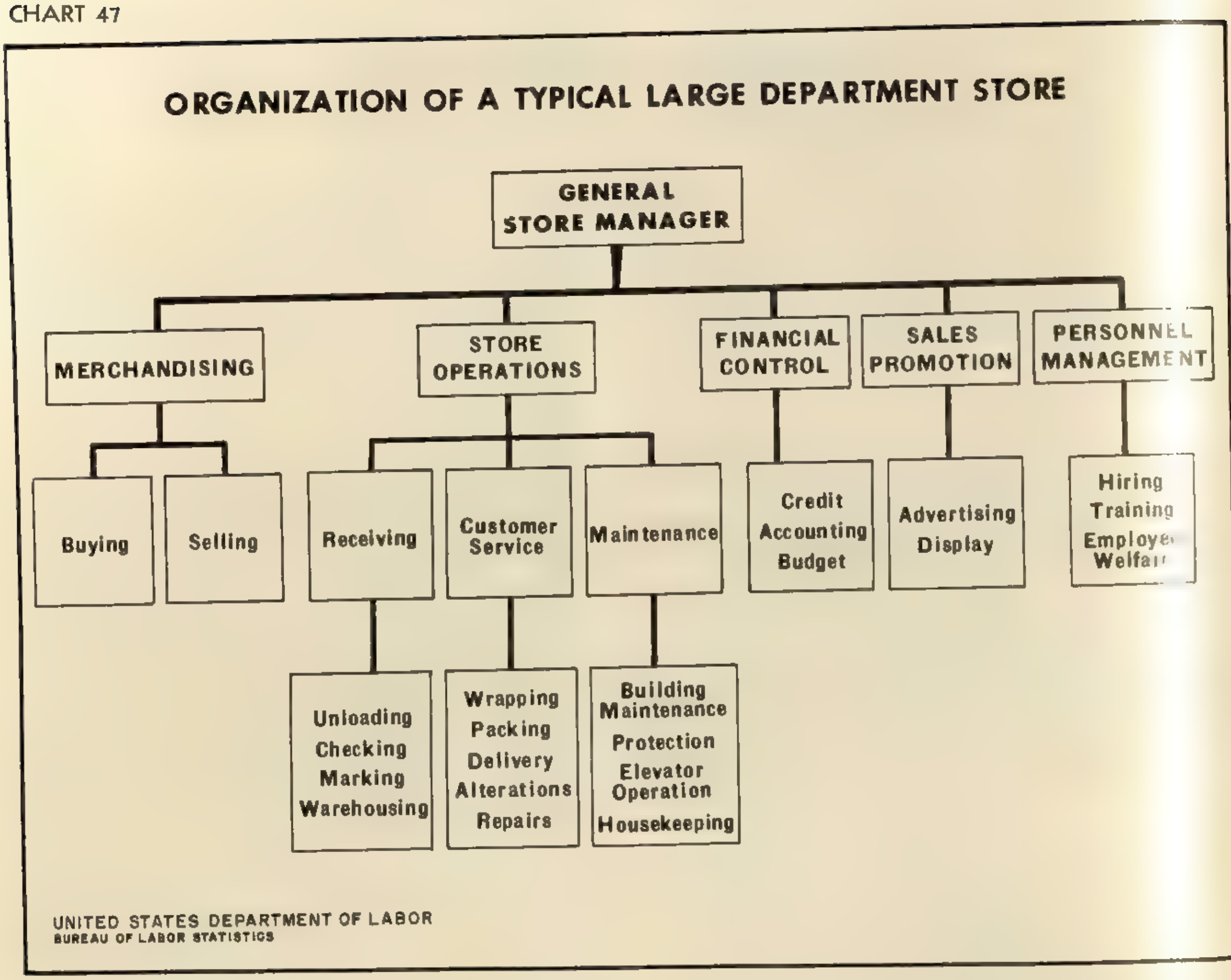
Department stores and their employees are concentrated in downtown areas of cities and, to an increasing extent, in the suburbs of large cities. Most of these stores are in the States with the largest population. However, some of the less populous States with expanding metropolitan areas also have substantial department store employment. Most major department stores—those with 500 or more employees—are in big cities: New York, Chicago, Los Angeles, Philadelphia, Detroit, Pittsburgh, Cleveland, St. Louis, Boston, and Washington, D. C. Most medium-size cities also have department stores. Though such stores are not found frequently in the thousands of small cities and towns with less than 10,000 population, many of these towns are located within commuting distance of department stores, which offer both shopping facilities and employment opportunities to their residents.

Department Store Occupations

Department store work includes five major functions—merchandising, store operations, financial control, sales promotion, and personnel management. (See chart 47.)

Merchandising—the buying and selling of goods—is the hub of all department store work, and the great majority of employees in merchandising work are directly engaged in selling. The proportion of salespersons tends to be somewhat lower in large than in small stores, since the larger stores have a greater number of specialized sales-supporting personnel to handle customer services and other activities needed to complete a sale. In stores with sales amounting to more than $50 mil-

CHART 47



lion annually, approximately 45 percent of the workers were salespersons in 1955, compared with more than 60 percent in stores with annual sales of $1 to $2 million. Salespeople include not only regular, full-time employees but also many thousands who work part time regularly every week or for only a few weeks during the year. It has been estimated that about 20 percent of all department store sales personnel are employed on a part-time basis.

Personnel concerned with merchandising work also include an important group of executives—the buyers and their supervisors, the merchandise managers. These merchandising executives, who try to anticipate consumer preferences when buying goods, comprise a majority of all department store executives.

The largest group of workers behind the scenes in department stores is engaged in store operations. In this group are many thousands of employees who receive, check, and mark prices on merchandise to be sold, or wrap and deliver goods after they are purchased. Workers with special skills—fitters, seamstresses, tailors, upholsterers, carpet and linoleum layers, and various types of repairmen—make alterations and repairs on merchandise as part of the service given customers. In addition, since department stores are usually located in large buildings, some covering an entire city block, they need many skilled maintenance workers, such as carpenters, electricians, and plumbers. They also employ detectives and guards to prevent the theft of merchandise and otherwise protect store property; elevator operators; and porters, maids, and janitors to keep the store clean and perform other incidental duties.

Office workers comprised about 15 percent of all department store employees in 1950. Some of these clerical workers—file clerks, typists, stenographers, and secretaries—do office work in con-

nection with sales promotion, personnel management, and other nonfiscal aspects of store management. However, the majority are employed in financial control work. Large numbers of bookkeepers, office-machine operators, and other office workers are needed to handle customers' charge accounts and to keep inventory control, accounting, and budget records. Especially large numbers of clerical workers are employed in big downtown stores which may handle recordkeeping and other office work for branch stores, as well as for their own operations.

A few store employees, mainly people with special creative ability, work on sales promotion. Advertising copywriters, layout men, commercial artists, and other specialists in advertising and publicity, prepare material for publication in newspapers or for radio and television "commercials." They also plan promotional campaigns to bring more customers to their stores. Window trimmers and interior display specialists arrange displays of goods to attract customers.

Supervisors and executives represent approximately 10 percent of all department store employees. Their positions range from that of section or floor manager to such high-level administrative posts as general store manager in charge of the store, controller, and personnel manager. As mentioned before, the buyers and the people who supervise them are included in this executive group. Although the trend is toward hiring more young college graduates as trainees for executive positions, outstanding salespeople and other experienced employees will continue to have good opportunities for advancement to top positions. Department stores also employ specialists and professional workers—personnel workers, accountants, lawyers, nurses, and doctors.

In most major divisions of department store work, women employees are in the majority. Furthermore, women have excellent opportunities for advancement in this business; they comprised approximately 40 percent of all salaried executives in department stores in 1955—a higher proportion than in most major industries. Although most of these women executives are in merchandising work, many are also employed in the controller's division, in sales promotion, and in personnel management.

The work done by buyers, sales personnel, and employees in receiving, delivery, and related jobs—some of the largest and most characteristic groups of department store workers—is described in the separate sections on these occupational groups later in this chapter.

Office workers in department stores are not discussed separately since their duties and qualifications are similar to those of clerical workers who handle office records and correspondence in other industries discussed elsewhere in this Handbook. (See statements on insurance occupations; banking occupations; and also the section on clerical occupations.) Similarly, many of the types of workers employed in store operations (for example, skilled maintenance workers) or those performing specialized services (for example, beauticians and watch and jewelry repairmen) and some of the types of professional personnel utilized by department stores (such as accountants, personnel workers, and commercial artists) are also to be found in other fields of employment. (See index for references to the discussion of many of these occupations in other sections of the Handbook.)

Employment Outlook

Many thousands of job openings, especially for beginners, are expected in department stores each year, continuing into the 1960's. Most openings—probably more than 100,000 annually—will result from employee turnover, including resignations, deaths, and retirements. The greatest number of job opportunities will be for salespersons, the largest occupational group, but many clerical workers will also be needed. Sales and clerical jobs have the highest turnover rates, because the majority of workers in these jobs are women, many of whom leave to get married or take care of their families. Turnover is high also among beginners in many sales-supporting jobs, such as those of checker, marker, wrapper, receiving or shipping clerk, and deliveryman—since the experience acquired in these jobs in department stores qualifies young people for work in a variety of other businesses. Thus, many thousands of openings will be available for such positions. In addition, a continuing demand is anticipated for qualified young people to train for executive positions, including those of buyer and sales manager, particularly because of the establishment and growth of branch stores. Some openings will also be

available for accountants, advertising and display artists, personnel workers, and other professional and specialized personnel.

Besides openings due to turnover, some job opportunities will arise during the next several years, as new branch stores are established in suburban areas. Many branch stores, most of them considerably smaller than the parent downtown stores, have already been opened in suburban shopping districts, and more such stores will be established, as long as population continues shifting to areas around large cities. However, industry leaders anticipate continuation of the trend toward the building of large branch stores in giant "regional" shopping centers. In these centers, stores will be bigger, handle a wider assortment of merchandise, and create jobs for larger numbers of workers than most earlier established branch stores. Since relatively more salespeople are employed part time in branch than in parent stores, a comparatively high proportion of the new openings will be in part-time work.

Employment is likely to remain fairly stable in downtown department stores while new branches become established and grow. Large staffs will still be needed in city stores, which are expected to continue to have a substantial sales volume even though branch stores will probably show greater proportionate increases in sales. Moreover, parent stores will perform a number of functions for branches, such as buying, advertising, accounting, and warehousing of merchandise.

In the department store business as a whole, future employment growth will probably be moderate compared with that which occurred in the 1940–50 decade, when employment rose by more than one-third. Most of the rise occurred immediately after World War II, as more goods and personnel became available. During the late 1940's and the first 6 years of the 1950 decade, department store employment was fairly stable, with an annual average of about 800,000 workers. Relatively small year-to-year fluctuations in employment occurred during this period, however, and are likely to continue.

The expected further growth in the population of the United States and rising income levels will play an important part in the anticipated long-run increase in department store employment. However, future levels of business and employment in these stores will also depend to a great extent on how effectively they meet the intense competition from other types of retail establishments. Undoubtedly, the total demand for merchandise will, if favorable economic conditions prevail, continue to grow rapidly. A greater population with more money to spend will purchase an ever-increasing amount of clothing, furniture, housefurnishings, radio and television sets, and other goods. But specialty stores of certain kinds have, in recent years, increased their share of retail sales. Between 1948 and 1954, when department store sales rose by 12 percent, there was a similar rise (14 percent) in apparel store sales but a much greater rise (30 percent) in sales of other specialty stores, such as those selling furniture and household appliances.

By 1956, many department stores were already making successful efforts to meet the mounting competition, and others are expected to follow suit. Neglected downtown shopping areas are being improved by store modernization programs; arrangements for customers' parking or transportation are being expanded; and local governments are being asked to cooperate by taking steps to ease congested traffic conditions. In addition, credit facilities are being further emphasized, in order to stimulate purchases. Also, some stores have adopted methods used by their competitors; for example, a new suburban store, described as a combination supermarket, discount house, and bargain basement, is making great use of self-service methods and cut-rate prices. Unique promotional campaigns, warehouse sales, and more night openings are further means by which department stores may try to increase their business.

The rise in department store sales expected as a result of these measures will probably not lead to an equally rapid rise in employment, for several reasons. Some office workers may be displaced by the introduction of improved office equipment—a change commonly referred to as automation. For example, electronic devices are being perfected which will record sales data from price tags in the form of machine punch cards, thus reducing the bookkeeping work involved in inventory control and in handling customers' accounts. Similarly, improved mechanical equipment for handling merchandise may affect employment in certain sales-supporting occupations, such as that of stockman and porter. The probable effect of

another development—the use of self-service techniques—on employment of salespersons is discussed in the statement on salespeople later in this chapter.

Because of the many offsetting factors which will influence the demand for workers in department stores, the future rate of employment growth in this business is uncertain. However, some increase in the numbers of department store employees is expected, as already indicated, and there will no doubt continue to be many thousands of openings in these stores each year owing to turnover.

Furthermore, regular employees of department stores have a better chance of stable employment over a long period of time than workers in many other industries. If department store sales should slacken, employment could be reduced without laying off regular employees by not filling vacancies.

Earnings and Working Conditions

Inexperienced salespersons generally earned from $30 to $40 a week in early 1956, although beginning salaries above $40 were paid in many large department stores. After the first few years, earnings of salespeople may rise by $5 to $10 or more a week. Salaries are generally increased with satisfactory performance in the same job or when the employee is transferred to a job requiring greater selling ability. Sometimes salespeople, mostly women, fail to progress because they do not remain long enough to qualify for better jobs or because they do not have the selling aptitude needed for better paying sales positions. Although salaries may vary depending on the size of a store and its geographic location, the greatest differences in earnings of salespeople result from differences in the types of goods sold and the selling skills required. For example, salesclerks who sell merchandise such as handkerchiefs, notions, and small housewares, usually earn less than shoe salesmen, who may average more than $60 or $70 a week. The highest earnings—averaging $100 or more a week in some large cities—are usually received by men who sell furniture, major appliances, or floor coverings. Commission earnings—a percentage of sales—are commonly paid in such departments and often a specified minimum amount is guaranteed in order to cover slack selling periods. Salespersons in most other departments usually receive a fixed salary or a salary plus commissions. Part-time employees are usually paid on an hourly rate basis, but many also receive commissions on sales.

Average weekly earnings of employees (salespersons, sales supporting, and other employees) below the supervisory level in department stores were approximately $50 in mid-1956. However, this figure includes earnings of part-time workers who usually work not more than half the number of hours worked by full-time employees. Salaries in a number of sales-supporting jobs below the supervisory level compare favorably with and, in some cases, are higher than the earnings of salespeople.

Executive trainees, many of them college graduates who eventually become buyers, generally received salaries ranging from $50 to $80 a week in 1956. Salaries are usually higher in large than in small stores, and sometimes men are paid more than women. A few stores pay above average entrance salaries to college graduates with advanced degrees. Full-fledged buyers usually receive salaries plus commissions or annual bonuses based upon sales or profits in the department for which they purchase merchandise. A recent study showed that more than half of the executives in major department stores (many of them buyers) earned over $5,000 a year, and that more than 10 percent made over $10,000. In a few large stores in 1955, all buyers earned at least $7,000 a year, and the best paid earned from $20,000 to $40,000. Many top executives, such as general merchandise managers and vice presidents, have even higher earnings.

Most department store employees work a 5-day week of 40 hours or less, although the stores, as a rule, are open 6 days a week. They usually work on Saturdays, when sales volume is heavy. Before Christmas and in a few other peak seasons, longer hours may be scheduled; most stores give nonsupervisory employees additional pay or extra time off during slack seasons to make up for this overtime. Large department stores usually pay a higher than regular rate for hours on duty beyond the normal work schedule. When employees work evenings (usually one evening each week) supper money is often provided. Buyers and other executives may have the same work schedule as other employees, or they may work 6 days a week. They frequently work 5 and 6 days on alternate

weeks. However, they may receive longer vacations than nonsupervisory employees.

Department store employees and, in many cases, their direct dependents are usually allowed discounts of 10 to 20 percent or more on merchandise purchased in the store. Christmas and year-end bonuses for employees are also widely granted in department stores. Many large stores pay part or all of the cost for employee benefits such as life insurance, retirement plans, hospitalization, and surgical plans.

Generally, work in department stores is performed in clean, well-lighted, and often air-conditioned areas. However, some department store employees, including those in receiving, wrapping, and packing, and delivery jobs work in service buildings or warehouses or parts of the store where working conditions may be somewhat less desirable. Most department stores have employee lounges, and the larger ones usually have employee cafeterias where food may be served at low prices.

A small proportion of department store workers, principally in large cities, are union members. The union with the largest membership among department store employees is the Retail Clerks International Association. Another organization in the field is the Retail, Wholesale and Department Store Union. Several unions organize workers in certain occupational groups. Among these are the International Brotherhood of Teamsters, Chauffeurs, Warehousemen and Helpers of America; the Building Service Employees' International Union; and to a more limited extent, the Amalgamated Clothing Workers of America; and the International Ladies' Garment Workers' Union.

Where To Go for More Information

General information on department store employment may be obtained directly from personnel departments of department stores or from local associations of retail merchants in many of the larger cities.

High school students—or adults interested in evening courses—may obtain information on courses related to the retailing field by contacting the State Supervisor of Distributive Education in the Department of Education in the State capital, or the Superintendent of Schools or the Coordinator of Distributive Education in their local community.

A list of colleges offering specialized courses in retailing is available from:

American Collegiate Retailing Association,
24 Waverly Place, New York 3, N. Y.

Buyers

(D. O. T. 0–74.11)

Nature of Work

Buyers have the highly responsible job of selecting and purchasing from wholesale houses or manufacturers, the huge quantities of goods sold in their stores. A buyer in a large store may specialize in one type of merchandise, but in a smaller store, he may be responsible for purchasing several different kinds of goods. In any event, buyers must order adequate amounts of goods in the proper assortments to supply customer demands.

Buyers and their assistants comprise a majority of the more than 75,000 executives employed in department stores. A very large store may employ well over 100 buyers, in contrast to the smallest store where the owner and an assistant may do the buying. About half of all buyers in the business are women.

The exact nature of a buyer's work depends not only on the size of a store but also on the type of organization and other factors. In large national chains, where the buyer may have to purchase the entire output of a small factory or order goods in carload lots, his function is usually limited to buying. However, in many department stores, buyers (who may also be called department managers) direct all the activities involved in the operation of a sales department. In addition to buying, they usually assist in supervising and training salespeople, help prepare expense budgets, participate in planning sales promotional campaigns and merchandise displays for their department, and perform many other functions. Buyers deal with people at all levels—their own salespeople, department store executives, such as controllers or sales promotion managers, and salesmen from factories and wholesale houses.

In order to select goods that will be sold readily, successful buyers need a great deal of information about merchandise and merchandising. They try to anticipate consumer preferences by keeping informed of the latest fashions and products. They evaluate past sales records to determine the kinds of merchandise customers prefer and the prices they are willing to pay. Buyers also rely on information from sales managers in branch stores and on "want slips" prepared by salespeople. In addition, they often spend time on the selling floor of their department to obtain firsthand knowledge about the kinds of goods customers prefer. In many of the smaller stores, they help sell merchandise in their department.

Buyers must have a thorough knowledge of the cost of materials and be able to judge workmanship, in order to bargain skillfully with sellers and obtain the best values for the money spent. They keep informed about the goods available by reading trade magazines and catalogs, and also develop numerous contacts with sellers. In larger stores, buyers spend about 20 to 30 percent of their time visiting merchandise markets throughout the country; sometimes they make trips to foreign markets. To meet the keen sales competition from other stores, the buyer frequently examines reports prepared by "comparison shoppers." In addition, the buyer must take account of general business trends, economic conditions in the particular store localities, and of seasonal, social, and other factors that may affect department store sales.

Every department store employs someone who performs the buying function; however, buyers are mainly concentrated in large stores and the larger cities. Buyers employed in downtown department stores with branches also buy for these suburban units and visit them to keep informed of their needs. Buyers employed by large national chain organizations, where buying is centralized, usually work in the home office location. Centralized buying is also performed for groups of stores through "resident buying offices" which employ buyers in the Nation's principal market centers—New York, Chicago, San Francisco, Los Angeles, St. Louis, and Dallas.

Training and Other Qualifications

In selecting people to train for the position of buyer, department stores emphasize such personal characteristics as initiative, maturity, the ability to speak well, a pleasing personal appearance, and ease in dealing with people. Selling experience is also generally considered essential background for buyers' work. Other characteristics emphasized in selecting buyers are the capacity to organize one's work and to work under pressure, a thorough knowledge of merchandise, and the ability to bargain aggressively and skillfully with sellers.

Although formal educational training is seldom a specific requirement for buyer jobs, a growing proportion of buyers hired in recent years have been college graduates. These graduates may have majored in liberal arts, in business subjects, or in a variety of other fields. However, the most helpful preparation is a 4-year college course with a major in retailing. Such courses usually include retail buying and merchandising, fashion and design, store operations, consumer economics, and mathematics as applied to retailing—pricing, controlling inventories, and analyzing profit and loss statements. Although only a small number of universities and specialized schools offer full 4-year retailing programs, there has been a substantial increase in the number of colleges which offer one or more retailing courses. Study in distributive education programs at the high school level, discussed later in the statement on salespersons, is also helpful.

Since most department stores follow a promotion-from-within policy, outstanding young people who begin in sales work or even in some sales-supporting jobs have opportunities to advance to assistant buyer or buyer positions. In addition, many large department stores hire individuals, mostly college graduates or those with some college training, as trainees for executive positions, including particularly that of buyer. Large department stores may recruit trainees through contacts they maintain with colleges, or they may hire individuals who apply in person. Applicants are interviewed personally and, in some cases, given intelligence or aptitude tests.

Many large stores have formal training programs for executive trainees, which generally last from 6 months to a year. These trainees, including both newly hired college graduates and workers promoted from within, may at first receive formal instruction in merchandising subjects and

then be rotated in various jobs where they may handle customer adjustments, do clerical work for buyers, or serve as section and floor managers. Those without previous selling experience usually also work initially as salespeople. After a year or two, trainees may be assigned to work as head of stock or assistant buyers.

Individuals who demonstrate ability as assistants are promoted to buyer positions as openings arise. A broad estimate of the average time required to obtain this promotion is from 4 to 5 years; however, individuals may advance in much less time or wait a longer period, depending on the situation in a particular store. The National Retail Dry Goods Association indicates that a large proportion of buyer jobs are filled by men and women in the 25- to 35-year age group. In large downtown department stores which have suburban branches, the line of promotion may be from assistant buyer to sales manager in a branch store, and then to buyer in the parent store. Branch sales managers mainly have managerial duties, although they also help buyers by giving them useful information on buying needs. The most successful buyers may also have opportunities for promotion to division merchandise manager in charge of a group of departmental buyers, and later to general merchandise manager at the head of the store's merchandising activities. At the top of the "promotion ladder" are the policy-making executive jobs of general manager, vice president, and president. Most department store presidents have a background of experience as a buyer.

Employment Outlook

Employment opportunities for department store buyers are expected to remain favorable for the remainder of the 1950 decade, at least. In 1956, colleges which specialized in retailing education indicated that their graduates could readily find employment as trainees for department store executive positions, including that of buyer. In the years ahead, the majority of openings will result from deaths and retirements of buyers, and from resignations, especially among young assistant buyers or trainees who do not qualify for advancement or who leave their jobs for other reasons. A moderate number of new jobs will probably become available as new branch stores, which are expected to be larger in size and to stock more goods, are established. A few more assistant buyers may also be needed in parent stores, where buyers do the purchasing for branch stores. Nevertheless, competition will probably remain keen for buying positions, which are better paid and generally considered more challenging than some other department store occupations.

Women will continue to have good opportunities to become buyers, since employers generally recognize that women can compete on an equal footing with men in many buying jobs and are particularly successful in buying women's goods. Buyers in stores which centralize the buying for their branches may spend more time in the future on buying duties and less on managing departments and sales activities.

(See introductory section of this chapter for *Earnings and Working Conditions* and for additional information on *Employment Outlook*.)

Salespersons

(D. O. T. 1–70.10; 1–75.; 1–97.)

Nature of Work

Salespersons in department stores spend most of their time behind counters or on sales floors, selling one kind or related kinds of goods. Since they are in contact with the public more than other employees, they can help greatly to build the store's reputation by efficient and courteous service.

In large stores, salespersons usually sell a particular type of merchandise—for example, junior-miss dresses, women's and misses' better dresses, or women's inexpensive dresses. In smaller stores, they may handle several related kinds of stock, such as various dress lines and also women's suits and coats, or they may sell widely differing kinds of merchandise throughout the store. The successful salesperson not only sells a large volume of goods but also has a favorable record showing a minimum of sales returns by customers.

After greeting customers and finding out what types of merchandise they want, salespersons help them in their selections and may suggest additional merchandise for purchase. During peak selling periods, they must have the ability to wait

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Saleswoman helps customer select gloves.

on more than one customer at a time. It is obvious that the person who sells articles such as stationery or candy does not have to use as much salesmanship as the person who sells television sets, furniture, or fashion merchandise. However, each salesperson needs a thorough knowledge of the goods in his department, in order to emphasize the chief selling points and serve customers properly. He must usually be able to discuss differences in style, color, size, quality, and price and may also show customers how to use and take care of merchandise.

When the customer has decided what he will buy, the salesperson fills out a sales slip specifying the items bought; the price; the amount due for taxes, if any; whether the purchase was made on a cash, C. O. D., or charge basis; and any delivery arrangements. Salespeople also usually make change for customers, using a cash register. At the end of the day, they must compare cash register totals with their sales sheets and turn in their cash together with sales slips.

Salespersons must keep their stock in order and neatly arranged. When goods run low, they may order an additional supply from reserve stock, and if requested merchandise is not available in the store, they often fill out "want slips" to guide the buyers in ordering goods. From time to time, they assist in taking inventory. In smaller stores, they may also mark goods, put away stock, do display work, run errands, and help keep the store clean. The alert salesperson has a general understanding of store operations, so that he can explain the services available and direct customers to the appropriate departments. Sometimes, salespeople are assigned to work as "comparison shoppers." This job involves visiting other stores and obtaining information about styles, quality, and prices of goods in order to help their employer evaluate and adjust merchandising policies.

Training and Other Qualifications

Employers in department stores prefer high school graduates for saleswork. Applicants should have an aptitude for selling and the personal qualities necessary for work where contacts with people are important. A pleasing manner, a neat appearance, and the ability to speak distinctly are assets for salespeople. They must also be physically able to be on their feet all day.

Although specialized educational courses are not required for beginning sales jobs, high school subjects such as commercial arithmetic, speech, and home economics courses which give merchandise information are useful. The most helpful educational preparation is that obtained under the "distributive education" program offered in many local school systems. Under this combined work-and-study program, students are employed part time, at least 15 hours per week, in department or other retail stores. They also take school courses in such subjects as salesmanship, retailing arithmetic, speech, marketing, and the identification and care of all kinds of materials—textiles, woods, or plastics—used in consumer goods. Participation in this program not only helps young people determine if they like department store work but also gives them valuable experience.

Young people who are interested in sales jobs may apply directly to department store personnel offices. Applicants are generally given personal interviews. The applicant who fills out his application form carefully and makes a favorable impression during his interview has the best chance of employment. Some stores give aptitude tests for hiring and job placement purposes. People who have had part-time selling experience are likely to receive preference for full-time jobs. Inexperienced young people are often assigned to sell goods in departments where salesmanship may not be an important factor.

Most department stores have in-service training programs for newly hired salespeople. Large stores usually hold formal training sessions last-

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ing about 3 days to acquaint newcomers with store rules, teach them how to fill out sales slips and use the cash register, and to explain credit facilities and other practical matters. Some stores also stress salesmanship in these preliminary training programs. However, new workers learn how to sell mainly through actual sales experience, usually under the guidance of an experienced worker, called a sponsor. Many stores help their beginning salespersons in still other ways—through followup training sessions on salesmanship, assistance from section heads or floor managers, and regular meetings with the buyers aimed at providing information on the merchandise. Such information is important, because customers are most likely to buy from salespeople who show that they are thoroughly informed as to style, quality, price, and use of the merchandise they are selling.

A promotion-from-within policy for salespersons is followed by most stores. Salespeople are rated chiefly on their sales and service records and ability to deal with people. As openings develop, salespersons may be promoted to section head or head of stock and then to assistant buyer and buyer, or they may be transferred to sales jobs in better paying departments requiring greater selling skills, and later move up the ladder to positions as buyers. Sometimes, salespeople are transferred to and advance in nonselling jobs, such as those in personnel work or store operations. Advancement opportunities for outstanding young people who have little specialized education are better in the department store field than in a number of other industries. It should be borne in mind that experience in sales work in department stores is transferable to jobs in many other types of retail businesses.

Employment Outlook

Many employment opportunities for salespersons are expected each year in department stores, continuing into the 1960's. A number of workers will be needed to fill new positions, especially in new branch stores, but far greater numbers will be required to replace those leaving the occupation. The fact that most salespersons are women is one major reason for the high replacement rate in sales jobs. In addition, many young people change employment after gaining some sales experience.

In 1956, some department stores had difficulty hiring enough salespeople for full-time jobs, and most stores had even greater difficulty hiring part-time help, on either a year-round or seasonal basis. This situation will probably persist throughout the remainder of the 1950 decade at least, assuming that general business conditions remain good. Thus, there will continue to be many employment opportunities not only for young people, but also for older people and housewives, especially as part-time workers in suburban stores.

Growth in employment of sales personnel will depend in part on the extent to which employers use self-service techniques. These techniques are designed to help customers examine and purchase goods easily and quickly with little assistance from salesclerks. However, it is not expected that complete self-service will be greatly extended in department stores, since customers appear to prefer personal attention from salespeople. Although department stores have experimented with self-service methods for many years, they have been used only on a small scale by most stores, and least of all for the sale of goods which require an evaluation of quality or demonstration by salespeople. However, if employers should make widespread use of self-service methods, growth in the employment of sales personnel would be limited.

(See introductory section of this chapter for *Location of Work, Earnings and Working Conditions*, and for additional information on *Employment Outlook*.)

Receiving, Delivery, and Related Occupations

Nature of Work

Many thousands of department store workers—receiving clerks, checkers, markers, packers, package routers, sorters, and deliverymen—are required to handle merchandise, in order to get it to the selling floors and delivered to the customer. Men are usually employed where the work involves handling heavy merchandise, as in unloading operations or bulk packing. However, many women are employed as wrappers or stock girls, where physical strength is not an important factor.

The number of receiving, delivery, and related workers in each store depends mainly on the size

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Receiving clerk and his assistants check incoming merchandise.

of the store and the amount and type of customer service provided. In small stores, an employee may have a variety of duties; for example, a receiving room worker may help unload merchandise, unpack goods, and check for damage or shortages, and also help in marking operations. In the largest stores where huge stocks of merchandise are handled, large staffs are required. Specialization is feasible in such stores, and each worker is assigned a few specific duties.

The movement of goods in large department stores to the sales counters and selling floors requires the cooperative effort of workers in a variety of occupations. Warehousemen and porters unload merchandise from shippers' cars and trucks—often using forklift trucks, conveyor belts, and other mechanical equipment. After stock is unloaded, *receiving clerks* (D. O. T. 1–34.04) compare the shippers' invoices with the number of merchandise packages to see that quantities are correct. Goods are then sent to the *receiving checkers* (D. O. T. 1–34.15) who unpack and check each item for quantity, price, and color, and carefully examine goods for any damage. *Markers* (D. O. T. 1–12.47) indicate the retail price of each item by using crayons, rubber stamps, or price tickets. They check back to invoices to make sure that the price and departmental identifications are correct. Sometimes, markers use special machines that mark the ticket and attach it in one operation. In large stores, making price tickets and marking merchandise may be separate functions. The last operation in receiving work is usually performed by *stock clerks* (D. O. T. 1–38.01) who store merchandise in stockrooms and fill orders for stock as it is needed on selling floors. *Stock boys and girls* (D. O. T. 9–88.40) bring merchandise to sales counters from reserve stockrooms in the store, when salespeople need additional items.

Packaging "sold" merchandise for delivery to customers is done mostly by *wrappers* and *packers* (D. O. T. 9–68.30). Wrappers select a box or carton of the proper size and wrap items securely and neatly. Fragile goods and bulky items are usually handled by packers, who use large, well-made cartons and boxes to protect merchandise against damage. After the merchandise is packaged and properly addressed, it is sent to the delivery department for routing, sorting, and delivery. *Routers* (D. O. T. 1–34.11) place route numbers on packages according to delivery addresses, and *sorters* (D. O. T. 1–34.10) place the packages in bins according to route numbers. Sometimes the router or sorter also does the work of a *sheet writer* or *stubber* (D. O. T. 1–34.08), whose job is to go from bin to bin and record information about outgoing parcels on a record sheet or remove and file stubs attached to packages. Finally, the goods are loaded in delivery order sequence by the delivery truck driver who may be assisted by a helper.

Training and Other Qualifications

Young people with little formal education may be hired for many beginning jobs, such as receiving clerk, checker, marker, and stock boy and girl. However, some stores prefer high school graduates. Good work habits and traits such as punctuality, a sense of responsibility, initiative, and leadership are personal assets which help in advancement. Workers in a number of these jobs must be physically able to be on their feet for long periods or to handle heavy and bulky packages.

Like prospective salespersons, young people seeking beginning jobs in store operations may apply to department stores in their local shopping districts. Under the promotion-from-within policy followed by most department stores, workers already employed in the store receive first consideration for supervisory positions. A receiving

clerk or marker, for example, may be promoted to "squad head" in charge of a group of receiving room workers. Further promotions to such positions as receiving room supervisor and assistant manager or manager of inside delivery usually depend on an individual's leadership qualities and demonstrated ability.

Although a person's educational background receives little emphasis in beginning receiving and delivery jobs, it can be an important factor in promotion, particularly since capable workers in these occupations are often offered opportunities for advancement in other lines of department store work. For example, outstanding workers who also have the qualities generally considered desirable for salespeople may be transferred to saleswork and move up the "job ladder" in the merchandising field. High school graduation, generally preferred for selling work, is particularly helpful if the curriculum included courses in retailing given under the distributive education program.

Employment Outlook

Many thousands of openings for receiving, delivery, and other workers in related occupations are expected each year continuing into the 1960's. Most of the openings are expected to occur from the high replacement rate resulting mainly from younger employees shifting to other jobs in the department store business or changing to other employment. The same basic factors that underlie the employment outlook for department store salespeople—rising population and income, and increasing retail sales—are expected to affect employment prospects favorably for workers in jobs connected with receiving, stocking, and delivery operations.

In 1956, some large stores had difficulty filling vacancies in routine store-operation jobs. The general shortage of young people (18–21 years of age), who are usually preferred for most types of receiving, packing, and delivery jobs, had improved employment opportunities for people in the older age groups, particularly in jobs where physical stamina is not an important factor.

Over the long run, most job openings will continue to arise from the need to replace workers who leave their jobs. A moderate number of new jobs will probably become available as branch stores are opened in expanding suburban areas. However, proportionately fewer sales-supporting workers than salespersons may be hired in branch stores, since parent stores usually perform some nonselling functions for branches. Though new and improved equipment for handling merchandise will probably continue to be introduced in shipping and receiving departments, this development is expected to affect only a small proportion of employees, mainly unskilled workers who move merchandise. Jobs of checkers, wrappers, or stock clerks will probably be little affected.

A prolonged economic downturn would likely affect receiving and delivery workers more seriously than sales personnel. Only a small proportion of store operations workers are employed part time, compared with sales workers. Therefore, layoffs of regular store employees in jobs connected with receiving and delivering goods could not be reduced to any extent by cutting down on the number of part-time employees, as might be done in the case of salespeople.

(See introductory section of this chapter for *Location of Work*, *Earnings and Working Conditions*, and for additional information on *Employment Outlook*.)

OCCUPATIONS IN THE ELECTRIC LIGHT AND POWER INDUSTRY

The Electric Light and Power Industry and its Workers

America's technological advancement in the past 75 years could not have been possible without electric power. Electricity is used today not only to supplement the working power of the men and women who produce the Nation's goods and services, but also to heat, cool, and light homes and commercial establishments.

Today, about 55 million customers including homes, stores, and factories are serviced by our utility systems which generate, transmit, and distribute electric energy. Many different types of technical and skilled workers are needed to insure the dependable electrical service that utility systems provide. These include such workers as electrical engineers, powerplant operators, electricians, linemen, meter readers, and workers in office occupations. In many communities, the local utility is one of the best sources of interesting and steady jobs.

Nature and Location of the Industry

The electric light and power industry is made up of utility systems which make and distribute electric current for lighting, heating, and operating electrical appliances and machinery used in homes and industry. An electric utility system uses a complex set of equipment—powerplant, substations, and wires—to make electric current and carry it directly to places where it is used.

The instantaneous delivery of electricity to the user as he needs it is the distinctive feature of the operation of electric power companies. Electricity is a form of energy which cannot be efficiently stored in large quantities but must be used almost at the same moment it is produced. Each customer can begin to use current or increase his consumption at any time by merely pushing a button. For this reason, a power company must have sufficient capacity to meet peak consumer requirements.

Some utility systems generate, transmit, and distribute only electrical energy; other systems produce both electricity and gas. This chapter is concerned with employment opportunities only in those jobs relating to electric light and power in both types of utility systems. In 1956, private utility systems which generate and distribute only electrical energy employed about 253,000 workers. The private combined gas and electric systems had about 173,000 employees, of whom an estimated 70 percent were working in connection with electric service. In addition to employees found in private utility systems, an estimated 65,000 workers were employed by Federal, State, and municipal utility systems. Manufacturing companies which produce electric power for their own use also employ workers in this field.

Electric utility service now reaches into almost every locality. About 3,500 electric systems served almost 25,000 communities and rural areas in 1956. Electric utility jobs are found in small towns as well as large, and in rural areas as well as in urban communities throughout the Nation. Most jobs, however, are in the more heavily populated areas, especially where industrialization is extensive. Large cities have a disproportionately large share of electric utility employment, not only because they contain many customers, including large industrial users, but also because the headquarters of most of the large systems are in the cities. The extension of electric service into rural areas in recent years has brought more jobs into the smaller towns. Federal hydroelectric projects have created some new jobs in relatively isolated areas.

Electric Light and Power Processes and Jobs

The production and distribution of large quantities of electric power require workers in many different occupations. The number and kinds of jobs in electric utilities are affected by the heavy reliance on automatic equipment. In relation to the volume of sales, fewer electric utility employees are needed than in most other industries.

In mid-1956, about 14 percent of the workers in this industry were employed in generating plants. About 21 percent were employed in the processes involved in the distribution of power to customers. Because of the great amount of equip-

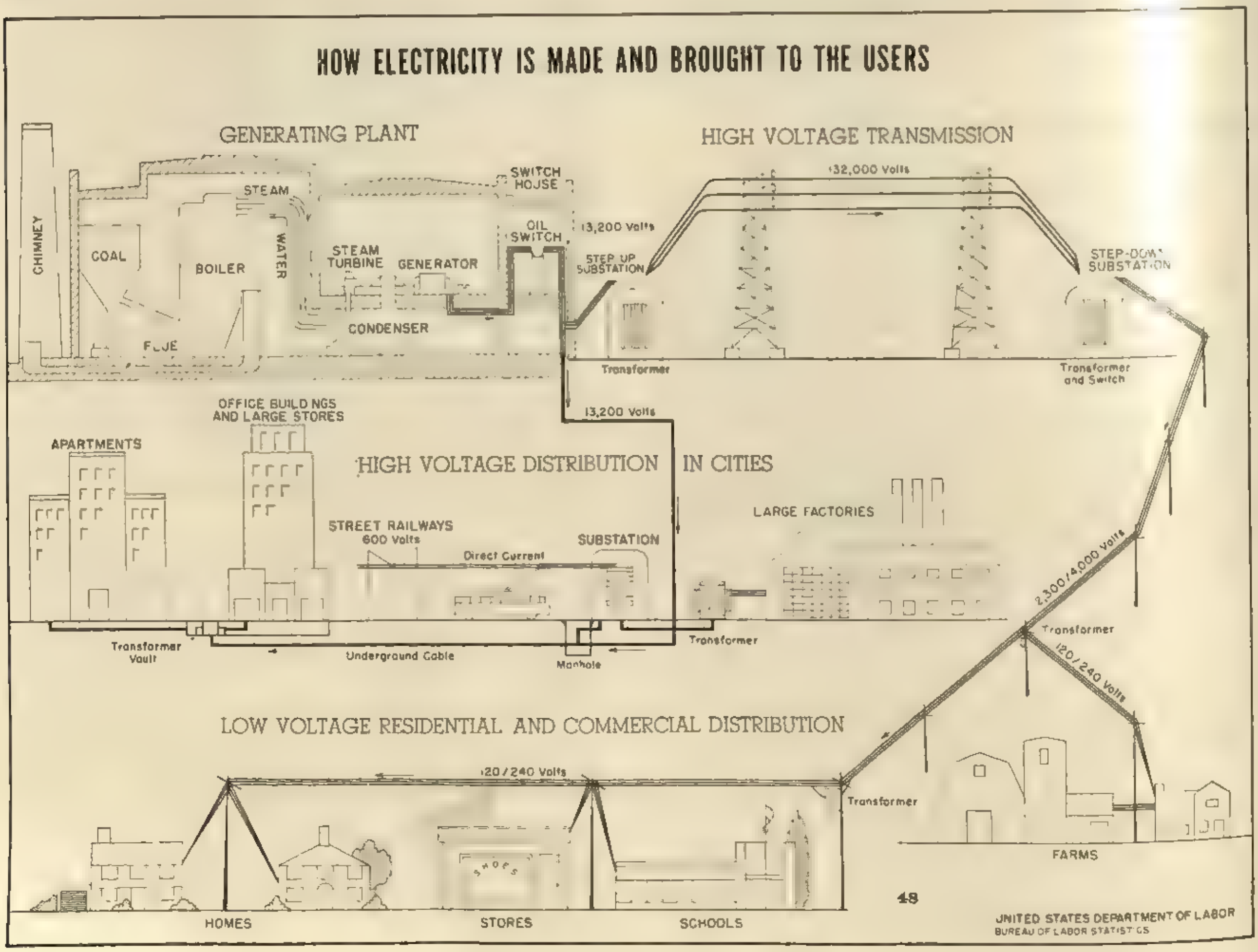
ment and facilities and the need for keeping them in good running order, about 17 percent of the workers in utility systems were employed in maintenance or custodial jobs. About 10 percent were in customer servicing jobs. Administrative and clerical workers together made up over 31 percent of the industry's work force and engineering and technical personnel comprised more than 7 percent.

The following brief description of how the electric utility system operates may help provide a clearer picture of the nature and organization of the jobs in this industry. Chart 48 gives a simplified picture of how electric current is generated and how the current travels from the generating station through the transmission and distribution systems to the individual users.

Powerplant Operations. The first process in providing electric power to consumers is the production of electricity in the powerplants of utility companies through the operation of electric generators. Most electric current is generated by means of waterpower or by steam which uses coal or oil as fuel. However, developments in peacetime nuclear research point to future large-scale commercial production of electricity with the use of atomic energy as a source for power generation. Basic powerplant jobs include boiler operators, turbine operators, and auxiliary equipment operators who watch over and check the equipment which produces the power. Groups of workers known as switchboard operators control the movement of the current through the generating station circuits and onto transmission lines carrying current away from the station to the users. Watch engineers supervise all powerplant employees.

Transmission and Distribution Operations. After electricity leaves the powerplant, it passes into the transmission lines which link the generating plant to the distribution network serving the individual

CHART 48



customers. Transmission lines may carry current from a distant hydroelectric powerplant to the city where it is to be used; or they may carry current from a power station in a city to distribution substations in the various neighborhoods or to substations in outlying areas served by the power company. Transmission lines also serve to tie together the generating stations of a single system or the power facilities of separate systems. In this way, power can be interchanged to meet varying demands.

From the generating plant, electric power is sent through a transformer in a step-up substation in which the voltage (measure of electric force or pressure) is raised in order to send electricity over distances by means of transmission lines. Transmission lines may be carried on tall steel towers across the countryside or they may be buried in lead-sheathed underground cable in cities. The transmission system ends at a stepdown substation where transformers reduce the voltage to a point at which the power can be passed on to the distribution system. Wires fan out into a network of other wires which are run to the final users of electric power. A large industrial user may be served by a line running directly from the substation. Individual homes get their current from secondary lines which branch off from the main lines leading away from the substation. The principal workers of the transmission and distribution systems consist of the men who control the flow of electricity—load dispatchers and substation operators—and the men who construct and maintain power lines—linemen, cable splicers, troublemen, and their helpers.

Customer Service. As the electric power enters the wiring system of a customer's building, it is measured by a meter installed by the local utility company. After the current is measured so that the customer can be billed for his consumption, the physical operations of the utility in bringing power to its customers are completed. Workers in customer service jobs include meter readers who read the consumption figures from the meter and metermen who install, test, and repair meters. Another customer service job is that of the district representative who generally is employed in rural areas. His work includes reading meters, collecting overdue bills, connecting and disconnecting meters, and making minor repairs on them. He also receives complaints about service and reports of line trouble and transmits them to a central office for handling.

The duties, training, and other qualifications; employment outlook; and earnings of workers engaged in powerplant, transmission and distribution, and customer service activities are discussed separately at the end of this chapter.

Maintenance and Custodial Activities. A considerable number of workers are engaged in maintaining and repairing the equipment used by the electric utilities. The duties of these skilled craftsmen are similar to those of maintenance workers in other industries. Among the more important workers in the maintenance jobs are electricians, instrument repairmen, maintenance mechanics, machinists, plumbers, and boilermakers. Electric utilities also employ custodial workers such as janitors, guards, and watchmen. (Detailed discussion of the duties, training, and employment opportunities in the important maintenance occupations appears elsewhere in this Handbook. See index for page numbers.)

Engineering and Technical Activities. Engineers plan generating plant additions and installations of new transmission and distributing equipment, supervise construction and installation, develop improved operating methods, and test the efficiency of the many types of electrical equipment. In most electric utilities, electrical engineers hold a large proportion of the top supervisory and administrative jobs. Many engineers are employed in sales development work to aid industrial and commercial customers in their utilization of electrical equipment and lighting. They stimulate greater consumption of electricity by demonstrating the advantages of electrical equipment and suggesting places where more electricity can be effectively used. About 7 percent of the total employment in this industry is made up of engineering and technical personnel including electrical engineers, draftsmen, and engineering aids. (A detailed discussion of the duties, training, and employment opportunities in engineering and other technical fields appears elsewhere in this Handbook. See index for page numbers.)

Administrative and Clerical Activities. Because of the tremendous amount of record keeping necessary for running the business operations of electric utilities, the industry employs a higher pro-

portion of administrative and clerical personnel than many other industries. Nearly a third of the industry's work force is employed in clerical and administrative jobs. Many of the workers in these jobs are women. Large numbers of stenographers, typists, bookkeepers, office machine operators, file clerks, and accounting and auditing clerks are employed by electric utilities. These workers keep records of the services rendered by the company, make up and send out bills to customers, and prepare a variety of statements and statistical reports. Administrative employees include such specialized workers as accountants, personnel officers, purchasing agents, lawyers, and salesmen. (A detailed discussion of the duties, training, and employment opportunities in clerical fields appears elsewhere in this Handbook. See index for page numbers.)

Employment Outlook

A continued slow increase in employment in electric utility systems is expected in the late 1950's and the 1960's. This rate of increase is expected to be slower than the overall growth of the Nation's total labor force. Job opportunities for new workers will arise primarily from the need to replace workers who die, retire, leave the labor force for some other reason, or transfer to other industries.

Since its origin in 1882, when it served 59 customers, the electric light and power industry has grown rapidly, and by 1956 it was serving almost 55 million customers. The following capacity and production data illustrate the rapid expansion of the electric utility industry since 1920:

Year	Capacity* (kw. in millions)	Production*(kw.-hr. in billions)
1920	12.7	39.4
1925	21.5	61.5
1930	32.4	91.1
1935	34.4	95.3
1940	39.9	141.8
1945	50.1	222.5
1950	68.9	329.1
1951	75.8	370.7
1952	82.2	399.2
1953	91.5	442.7
1954	102.6	471.7
1955	114.5	546.8

*Kilowatts measure the capacity of electric generators; kilowatt-hours measure the production of electricity—the amount consumed or sold.

The electric light and power industry had its greatest growth after World War II. The capacity of electric generators and the production of electric power both more than doubled in the decade since the war.

Continued large increases in demand for electric power are expected in the late 1950's and the 1960's. Levels of business and industrial activity, consumers' incomes, and population growth are major factors in determining the amount of electric power required. Demand for electric power is also affected by the introduction of new uses for electricity and by the greater use of existing equipment.

Analysis of the various factors affecting the demand for electric power indicates that electric light and power capacity and production may double in the 1956–66 decade. Future demands for electricity can be best understood by considering the needs of each of the principal groups of users of electricity. In 1955, industrial plants purchased more than half of the power sold by utility companies. The use of electricity has become essential in industrial operations for running motors, for lighting, for special processing in the chemical and metallurgical industries, and for many other operations. Considering both the favorable long-term economic outlook for industry in general and the new uses for electricity in industrial processes, a sustained long-run increase in the proportion of electricity consumed by industry may be expected.

Residential customers purchased about a quarter of the electric power from utility companies in 1955. Total demands by households for electricity will increase substantially during the 1956–66 decade because of the increasing population and the growing number of family units; the expected widespread introduction of new types of electrical appliances; and the wider use of already-established household appliances, such as television sets, air-conditioning units, and freezers.

About 17 percent of the electric power produced in 1955 was bought by commercial establishments, such as stores, office buildings, theaters, and hotels for light, air-conditioning, heat, and sign display. As new equipment, such as electric cooking equipment in restaurants, is more universally adopted, it is expected that consumption of electricity in commercial establishments will rise. Local, State, and Federal agencies and street and interurban railways and electrified railroads, which con-

sumed the balance of electric energy produced in 1955, are also expected to increase their use of electricity in the next decade.

Employment in the electric light and power industry has generally grown at a much slower rate than the increase in capacity and production. A unique situation arose during World War II when capacity and production expanded but employment dropped by 20 percent as thousands of the industry's workers entered the Armed Forces. Utility systems were able to carry on with fewer employees partly by curtailing service functions. Sales departments were discontinued and maintenance work was temporarily postponed wherever possible. Customers' meters were read every other month instead of each month, saving manpower time in reading meters and in preparing bills. At the end of the war, electric utility companies rebuilt their staffs and provided new services. From 1945 to 1949, employment increased by about 40 percent. Since 1949, employment has increased very slowly—about 1 percent a year. During this period (1949–56) production and capacity nearly doubled.

There are several factors responsible for this great increase in capacity and production of electric power without a comparable increase in the number of workers. The most important has been the increasing use of instrumentation and the installation of larger and more automatic equipment in generating plants and in transmission and distribution departments. With manpower needed mainly to check gages and control instruments, the introduction of new and more efficient equipment has made possible great increases in output per worker employed.

These and similar developments will continue to affect the number of new workers needed for the prospective utility expansion. Most of the new generating plants will be larger than those now in use, and larger powerplants require far fewer employees per unit of output. The plants will have modern layouts including centralized operations control operations which tends to reduce employment requirements. New equipment for transmission and distribution of power is generally more trouble-free and flexible than the older types, requiring less maintenance work and linework. More efficient billing and recordkeeping systems and equipment will enable utilities to handle more customers per clerical employee.

As a result of these factors, only a small increase in employment can be expected in the electric light and power industry despite the anticipated doubling of capacity and production during the 1956–66 decade. However, there will be some differences in the rates of growth among the different occupational groups employed by the electric utilities. For example, maintenance craftsmen will increase at a faster rate than most other occupational groups because of the need to maintain the growing amount of machinery and equipment. On the other hand, the building of unattended substations in residential areas may reduce the need for substation operators. (The employment outlook for some of the important electric utility occupations is discussed at the end of this chapter.)

Although the continued expansion of electric power output will create some openings for new workers, replacement needs will be the major source of job opportunities. The electric light and power industry employed almost 450,000 workers in 1956. Thousands of job openings for new workers will arise each year to replace those workers who die, retire, or transfer to other fields of work.

Earnings and Working Conditions

Earnings in the electric utility industry are generally higher than in other public utility industries and in many manufacturing industries. In December 1956, nonsupervisory employees of electric light and power utilities averaged $2.29 an hour and $94.58 a week.

Most nonsupervisory electric utility workers in the production, transmission, and distribution departments, are members of unions. The bargaining agent for most of these workers is the International Brotherhood of Electrical Workers or the Utility Workers Union of America. A number of independent unaffiliated unions also represent some utility workers.

Generally, electric utility union contracts call for premium pay for overtime work in excess of 8 hours a day or 40 hours a week and for holiday work. Most contracts also provide that the rate of pay for evening and nightwork be higher than the basic day rate. In 1956, this was generally about 10 cents an hour more than the basic day rate. Overtime work is sometimes required in this industry, especially during emergencies, such

as floods, hurricanes, or bad storms. During an "emergency callout," which is a short-notice request to report to work during nonscheduled hours, the worker is generally guaranteed a minimum of 3 or 4 hours' pay at his basic hourly rate, and travel time to and from the job is counted as worktime.

In addition to these provisions which affect the pay envelope directly, other benefits for utility workers are provided by electric companies. Periods of annual vacation are granted to workers according to length of service. Usually, contracts provide for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 15 years, 3 weeks for 15 to 25 years, and 4 weeks for over 25 years of service. The number of paid holidays a year varies from 6 to 12 days, depending on locality. Nearly all companies have sick leave provisions for their employees. A typical program provides that payments for sick leave be made to employees with more than 2 years of service. Provisions for sick leave beyond 7 days are covered in benefit plans adopted by most companies. The majority of electric utility workers are covered by group insurance plans which usually include sickness, retirement, and disability benefits.

The frequency of accidents per man-hour worked is much lower in the electric light and power industry than in most manufacturing industries. Workers in some occupations are more subject to accidents than others. Accidents occur most frequently among the line and cable splicing crews. Among the more frequent causes of injuries are electrical shock, falls from poles and towers, blows from falling or flying objects, and motor vehicle accidents. Around the generating plant and substation, failure to observe safety regulations while working near high voltage lines and equipment may jeopardize the life of the worker. Such accidents, however, are not common. Because of the dangers of electrocution and other hazards, the electric companies and unions have made intensive efforts to enforce safe working practices. Utility companies have set up safety rules for employees to follow. Strict adherence to safety standards is required. As a result, the accident rate has been declining in recent years. In 1955, there were 7.1 disabling injuries per million man-hours worked among the employees of electric utility systems as compared with an average of 12.1 in all manufacturing industries, according to a Bureau of Labor Statistics survey.

Where To Go for More Information

Additional information about jobs in the electric light and power industry can be obtained from the local electric utility company or from the local offices of unions which have electric utility workers among their membership. If no union is listed in the telephone directory, write to the following national headquarters and ask them to refer your letter to their nearest branch:

International Brotherhood of Electrical Workers,
1200 15th St., Washington 5, D. C.

Utility Workers Union of America,
1413 K St., Washington 5, D. C.

Powerplant Occupations

Nature of Work

The powerplant operators are the core of the powerplant staff. They are responsible for watching, checking, and controlling the operation of the various kinds of equipment. They must see that the equipment is functioning efficiently and detect instantly any trouble which may arise. There are four classes of powerplant operators—boiler operators, turbine operators, auxiliary equipment operators, and switchboard operators. Supervision of the operation of the powerplant is handled by a chief engineer and by the watch engineers under him. At the other end of the scale are the laborers and helpers who assist the operators.

Boiler Operators (D. O. T. 5–72.930). A boiler operator regulates the fuel, air, and water supply used in the boilers, and maintains proper steam pressure to turn the turbines. He does this by means of control valves, meters, and other instruments mounted on panel boards. One man may operate one or more boilers. In many powerplants the coal is fed to the boilers by mechanical coal stokers. In more modern plants, pulverized coal, oil, or gas is piped into the boiler. Coal and ash handlers, cleaners, and helpers remove the ash if coal is the fuel. Boiler operators, of course, are employed only in steam generating plants, none being needed in hydroplants.

By means of valves, meters, and other instruments, the boiler operator regulates the fuel, air, and water used in boilers.

Turbine Operators (D. O. T. 5–51.120). Turbine operators control and operate the turbines and generators. In small plants they may also operate auxiliary equipment or a switchboard. Modern steam turbines and generators operate at extremely high speeds, pressures, and temperatures; therefore, close attention must be given the pressure gages, thermometers, and other instruments which show the operations of the turbo-generator unit. The turbine operators record the readings of these instruments and also check the oil pressure at bearings, the speed of the turbines, and the circulation and amount of cooling water in the condensers which change the steam back into water. The turbine operators are responsible for starting and shutting down the turbines and generators as directed by the switchboard operator in the control room. Other workers, such as helpers, cleaners, and oilers, assist the turbine operators. Sometimes, auxiliary equipment operators are under his supervision.

Auxiliary Equipment Operators (D. O. T. 5–51.115). These workers regulate and tend such equipment as pumps, fans and blowers, condensers, evaporators, water conditioners, compressors, and coal pulverizers. They check and record readings on instruments which show how their equipment is functioning. Since auxiliary equipment may go out of order occasionally, the operators must be able to detect trouble quickly, make accurate judgments, and sometimes make repairs. The various types of auxiliary equipment are essential to the powerplant process since they are directly connected with the operation of the boilers and the turbines. As powerplants become larger, the auxiliary equipment increases in complexity and size and more of it is required to operate the plant.

In some of the smaller plants, there are no separate auxiliary equipment operators. The turbine operators handle this work along with their other duties. In larger plants, however, auxiliary equipment operators often outnumber turbine operators. The auxiliary equipment is used only in steam generating plants.

Switchboard Operators (D. O. T. 5–51.130). These workers control the flow of electric current in the generating station from generators to outgoing power lines. They usually work in a control room which is separated from the generating room and which has switchboards and instrument panels. Switches control the movement of current through the generating station circuits and onto transmission lines carrying the current away from the station to the users.

Instruments show such information as the power requirements on the station at any instant, the powerload on each line leaving the station, the amount of current being produced by each generator, and the voltage of the current. The operator uses the switches to distribute the power demands among the generators in the station, to combine the generator current, and to regulate the passage of the current onto various powerlines in accordance with demands of the users served by each line. When changing power requirements on the station make it necessary, he orders generators started or stopped and at the proper time connects them to the power circuits in the station or disconnects them. For most of these operations, he receives telephone orders from a load dispatcher in the system headquarters who controls the flow of current throughout the system.

The switchboard operator and his assistants also make tests frequently on instruments before them to see that current is moving through and out of the powerplant properly and that correct voltage and frequency are being maintained. Among his other duties, the switchboard operator keeps a log of all switching operations and of load conditions on generators, lines, and transformer banks. He

obtains this information by making regular meter readings.

In plants with high generating capacity, the equipment is generally more varied and complex than in smaller plants. Disturbances in the system may have far-reaching effects, causing interruptions in service over a large area. As a result, switchboard operators switch their lines and test their equipment more frequently than operators in smaller plants, and thus require a greater degree of skill.

In some of the new powerplants, duties of the switchboard operator may be combined with those of boiler operator and turbine operator. In such cases, he may be called a *control room operator.* Generally, these powerplants are constructed with controls from all departments centralized in the control room. From the central control room, the control room operator, with several assistants, watches all powerplant controls and directs the boiler repairman or the turbine repairman to make repairs when the instruments show that the equipment is not running properly.

Watch Engineers (D. O. T. 5–95.320). The principal supervisory workers in a powerplant are the watch engineers. They supervise the employees responsible for the operation and maintenance of boilers, turbines, generators, auxiliary equipment, switchboards, transformers, and other machinery and equipment. Watch engineers may be supervised by a plant superintendent who is generally in charge of the entire plant. In small plants, the watch engineer may be the top supervisory employee.

Training, Other Qualifications, and Advancement

New workers in powerplants generally are hired as laborers or cleaners. They gradually advance to more responsible jobs as they learn about operating the equipment and as openings occur. Formal apprenticeships in powerplant jobs are rare.

Typically, after starting as a laborer or helper, it takes from 1 to 3 years to became a fully qualified auxiliary equipment operator and from 4 to 8 years to become a boiler operator, turbine operator, or switchboard operator. A person learning to be a boiler operator might spend from 2 to 6 months as a laborer before being promoted to the job of oiler. Depending on openings and the worker's aptitude, the oiler may either advance to boiler helper and eventually to boiler operator, or he may transfer to the maintenance department and work his way up to boiler repairman. Most large cities require that boiler operators be licensed.

In many plants, turbine operators are selected from among the auxiliary equipment operators. The line of advancement in other companies is from laborer to turbine helper. The helper then may either advance to turbine operator or he may transfer to turbine repairman, depending on openings. Where a system has a number of generating plants of different size, operators get experience first in the smaller stations and then are promoted to the larger stations to fill vacancies. Most large cities require that turbine operators be licensed.

Switchboard operators work first as helpers, then as junior operators, and finally as senior operators. They also may be advanced from smaller stations to the larger ones because operating conditions in the larger stations are usually much more complex. Some utility companies take men from among the substation operators and transfer them to switchboard operating jobs. The duties of both classes of operators have much in common. In the larger plants, switchboard operators can advance to the job of chief switchboard operator.

Watch engineers are selected from the experienced powerplant operators. At least 5 to 10 years of experience as a first-class operator is usually required to qualify for a watch engineer's job.

Employment Outlook

Little increase in powerplant employment is expected in the late 1950's and the 1960's despite the anticipated large expansion of generating facilities. Replacement needs, however, will provide several hundred opportunities for new workers to enter this field of employment each year.

New plants and replacements for wornout and obsolete equipment have many automatic operating features not contained in many of the older units. This will greatly reduce the number of workers required per unit of capacity and output. For example, an operator can generally handle a large modern turbogenerator unit which turns out 150,000 kilowatts as well as he can one that produces half that amount. Moreover, occupations in generating plants are gradually being consolidated. With growing centralization of automatic controls, operators are able to tend more equip-

ment. For example, in some plants, 1 man and his helper can watch the controls for 3 boilers or 3 turbines. The addition of another boiler or turbine does not necessarily mean the addition of another operator. Furthermore, the trend has been to rotate boiler operators and turbine operators so they can get experience on both types of operations. These factors are resulting in little increase in employment in powerplant occupations despite greatly increased generating capacity.

Job openings will result primarily from the need to replace those workers who die, retire, or leave the industry to take other jobs. Death and retirement alone will create about 4,000 job openings in the 10-year period between 1956–66.

The introduction of atomic energy as a fuel, replacing coal, oil, and waterpower, will not greatly affect the number of skill requirements of powerplant employees. Generally, about the same number and types of operators will be required to run an atomic-powered plant as are required to operate a steam generating plant.

Earnings and Working Conditions

The earnings of powerplant workers vary according to the type of job and the geographic location of employment. An examination of a number of union agreements covering only the large cities in the northeastern and midwestern sections of the country indicates the following range of top hourly rates in selected powerplant occupations in mid-1956:

Boiler operator	\$2.25–\$2.90
Turbine operator	\$2.25–\$2.75
Auxiliary operator	\$1.95–\$2.75
Switchboard operator	\$2.45–\$3.05

A powerplant is typically well lighted and ventilated and its interior presents a very orderly appearance. Even steam plants are generally quite clean since coal is handled by mechanical equipment separated from principal work areas. The turbine room is airy and clean, but there is usually considerable noise from the whirring turbines. Switchboard operators in the control room often sit at the panel boards, whereas boiler and turbine operators are almost constantly on their feet. Not much strenuous activity is required of powerplant operators and rarely any lifting. Since generating stations usually operate 24 hours a day, 7 days a week, some powerplant employees must work nights and weekends.

Transmission and Distribution Occupations

Nature of Work

More than a fifth of the workers employed by electric light and power companies are in transmission and distribution jobs. These workers are primarily employed in getting electric power to the users. The principal workers of the transmission and distribution systems are the men who control the flow of electricity—load dispatchers and substation operators—and the men who construct and maintain power lines—linemen, cable splicers, troublemen, groundmen, and helpers. Linemen make up the largest single occupation in the industry.

Load Dispatchers (D. O. T. 5–51.520). Load dispatchers are the key operating workers of the transmission and distribution departments. They control the flow of electricity. The load dispatcher's room is the nerve center of the entire utility system. From this location, the dispatcher controls the plant equipment used to generate electricity and directs its flow throughout the system. He gives telephone orders to the generating station switchboard operators and to the substation operators. He directs how power is to be routed and determines when additional boilers and generators are to be started or shut down in line with the total power needs of the system.

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Pilot board in a load dispatcher's room. Load dispatchers direct the flow of power throughout the utility system.

The load dispatcher must anticipate demands for electric power before they occur so the system will be prepared to meet them. Power demands on utility systems are not constant; they change from hour to hour. A sudden afternoon rainstorm can cause a million lights to be switched on in a matter of minutes, but boilers often must be heated for as long as 2 hours before they are ready to produce sufficient steam for generating. The load dispatcher must, therefore, keep in touch with weather reports from hour to hour. He must also be able to direct the handling of any emergency situation, such as a transformer or transmission line failure, and to route current around the affected area. Load dispatchers are also in charge of the interconnections with other systems, and they direct the transfer of current between systems as the need arises.

The load dispatcher's source of information centers in the pilot board which dominates the dispatcher's room. The board is a complete map of the utility system which enables the dispatcher to determine at a glance the conditions that exist at any point. Meters show the output of individual power stations, the total amount of power being produced, and the amount of current flowing through the principal transmission lines. Red and green lights may show the positions of switches which control generating equipment and transmission and distribution circuits as well as high voltage connections with substations and large industrial customers. The board may also have several recording instruments which make a graphic record of operations for future analysis and study.

Substation Operators (D. O. T. 5-51.210). The substation operator is generally in charge of a substation and is responsible for its efficient operation. Under orders issued by the load dispatcher, he directs the flow of current out of the station by means of a switchboard. The switchboard in the substation is similar in purpose to the switchtower in a railroad yard. Incoming energy from the powerplant is switched to the outgoing lines on which it is needed. Depending upon the type of substation, electrical voltage may be either raised or lowered. The flow of electricity from the incoming lines to the outgoing lines is controlled by the circuit breakers. The substation operator connects or breaks the flow of current by pushing or pulling the switches which control the circuit breakers. Ammeters, voltmeters, and other types of instruments located on the switchboard register the amount of electric power flowing through each line. In some substations, where alternating current is changed to direct current to meet the needs of special users, the operator controls the converters which perform the change simultaneously.

In addition to his switching duties, the substation operator must check the operation of all equipment and see that it is maintained in good working order. He supervises the activities of the other substation employees on his shift, and assigns tasks and directs their work. However, in small substations he may be the only employee.

Linemen (D. O. T. 5-53.420). Linemen construct and maintain powerlines which carry electricity from the generating plant to the consumer. On new construction, special line crews customarily erect the steel towers for transmission lines. The digging of holes and the raising of wooden poles is largely done by the *groundmen* (D. O. T. 9-54.10) under the supervision of the linemen. The

Much of the linemen's work consists of repairs or routine maintenance.

linemen bolt or screw crossarms to the poles or towers, and nail or clamp insulators in place on the crossarms. With the assistance of the groundmen, they raise the wires and cables and install them on the poles or towers by attaching them to the insulators. In addition, linemen attach a wide variety of equipment to the poles and towers, such as lightning arrestors, transformers, and switches.

Although the installation of new lines and equipment is important, much of the linemen's work consists of repairs or routine maintenance. When wires, cables, or poles break, it means an emergency call for a line crew. Linemen splice or replace broken wires and cables and replace broken insulators or other damaged equipment.

In some power companies, linemen specialize in particular types of work. Those in one crew may work only on new construction and others may do only repair work. In some cases, linemen specialize on high voltage lines using special "hot line" tools.

Troublemen (D. O. T. 5–53.422). These workers are journeymen linemen with several years of experience who are assigned to special crews which handle emergency calls for service. They move from one special job to another, as ordered by a central service office which receives reports of line trouble. Often troublemen receive their orders by direct radio communication with the central service office.

Troublemen must have a thorough knowledge of the company's transmission and distribution systems. They first locate and report the source of trouble and then attempt to restore service by making the necessary repairs. Depending on the nature and extent of the trouble, a troubleman may restore service in the case of minor failure, or he may simply disconnect and remove damaged equipment. He must be familiar with all the circuits and switching points so that he can safely disconnect live circuits in case of line breakdowns.

Cable Splicers (D. O. T. 5–53.950). Cable splicers install and repair underground lines, performing about the same service as the linemen do on the overhead lines. When cables are installed, the cable splicers supervise the laying of the conduit and the pulling of the cable through it. The splicers then join the cables at connecting points in the transmission and distribution systems. At each connection or break in the cable they wrap insulation around the wiring and seal the cable with lead joints much the same as a plumber closes a pipe joint. Most of the actual physical work in the placing of new cables is done by the helpers and laborers who are members of the cable laying crew.

Cable splicers spend most of their time in repairing and maintaining the cables and changing the layout of the cable systems. Splicers must know the arrangement of the wiring systems, where the lines are connected, and where they lead to and come from. Each line is numbered throughout its length at every connecting point and switchbox and at the control board of the generating plant or substation. The splicers must make sure that the wires do not get mixed and that the continuity of each line is maintained from the substation to the customer's premises.

Training, Other Qualifications, and Advancement

Load dispatchers are selected from among the experienced switchboard operators and operators of the larger substations. Usually, at least from 7 to 10 years of experience as a senior switchboard or substation operator is required for promotion to load dispatcher. To fill an opening for this job, an applicant must demonstrate his knowledge of the entire utility system.

Substation operators generally begin as assistant or junior operators. It usually takes a total of 3 or 4 years of on-the-job training to become an operator in a large substation. Often workers begin in small substations and are promoted to larger stations as they become more experienced.

It usually takes about 4 years of on-the-job training to qualify as a journeyman lineman. In some companies, this training is given through a formal apprenticeship but in many systems, the training of linemen has not been formalized. Under a formal apprenticeship, there is a written agreement, usually worked out with the union, which covers the content of the training and the length of time the apprentice works in each stage of his training. A principal feature of apprenticeship as compared with informal training is that the apprentice is definitely assured of becoming a journeyman lineman if he completes his training satisfactorily. Also, his promotion from one training step to another occurs at specified intervals. The apprenticeship agreement generally contains a provision that at least 144 hours of classroom instruction a

year be given to the apprentice. The courses taken include blueprint reading, elementary electrical theory, electrical codes, and methods of transmitting electrical currents. In mid-1956, about 1,750 linemen were receiving their training under a formal apprenticeship program.

The apprentice usually begins his training as a groundman; he assists the lineman by helping to set poles in place and by passing tools and equipment up to him. After a training period of approximately 6 months, the apprentice begins to do simple linework on "dead lines" (lines of low voltage). While on this work, he is under the immediate direction of a journeyman lineman or the line foreman. After about a year, he is assigned more difficult work, but is still under close supervision. During the last part of his apprenticeship, the trainee does about the same kind of work as the journeyman, but with more supervision. When he begins to work independently as a journeyman lineman, he is first assigned more routine and less difficult tasks. After he acquires several years of experience and demonstrates a thorough knowledge of the company's transmission and distribution systems, he may advance from lineman to troubleman.

The training of lineman under the informal method is generally similar to the apprenticeship and usually takes about the same length of time. The worker begins as a groundman and progresses through increasingly difficult stages of line work before becoming a journeyman.

Candidates for linework should be strong and in good physical condition to carry on the strenuous work of climbing poles and lifting lines and equipment. They must also have steady nerves and good balance to work at the tops of the poles and to avoid the hazards of live wires and falls.

Cable splicers get their training on the job, usually taking about 4 years to become fully qualified. Workers begin as helpers and then are promoted to assistant or junior splicers. In these jobs, they are gradually assigned more difficult tasks as their knowledge of the work increases.

Employment Outlook

A continued slow increase in the employment of transmission and distribution workers is expected during the late 1950's and the 1960's. Replacement needs will provide most of the job openings in this field of employment.

There will be differences in the rate of growth among the various transmission and distribution occupations. Because of the need to construct and maintain the growing amount of transmission and distribution lines which are anticipated in the 1956–66 decade, the number of linemen and troublemen are expected to increase more rapidly than the other occupations in this field of work. However, even for linemen, the increase will be moderate. Little increase in the number of cable-splicers is expected because most large cities are already equipped with underground line installations and little expansion of underground construction is anticipated because of its high cost compared with overhead wire installations. The number of substation operators will show little, if any, growth. The introduction of improved and more automatic equipment and the growing use of unattended substations in residential areas may actually reduce the need for substation operators.

The need to replace transmission and distribution workers who die, retire, or transfer to other fields of work should result in a few thousand job opportunities each year.

Earnings and Working Conditions

The earnings of transmission and distribution workers vary according to occupation and geographic location of the job. An examination of a number of union agreements covering selected occupations in transmission and distribution departments in northeastern and midwestern sections of the country in mid-1956 indicated the following range of top pay rates:

Substation operator	\$2.30–\$2.90
Lineman	\$2.40–\$2.90
Groundman	\$1.80–\$2.10
Troubleman	\$2.55–\$3.10
Cable splicer	\$2.45–\$2.90

No recent earnings data are available for load dispatchers; however, according to past information, this is the highest paid transmission and distribution job.

Load dispatchers and substation operators generally work indoors in pleasant surroundings. Linemen and troublemen work outdoors in all kinds of weather and they must do a considerable amount of climbing. Cable splicers do most of their work in manholes beneath city streets—often in cramped quarters. Safety standards developed over the years by utility companies, with the cooperation of unions, have greatly reduced the hazards of these jobs.

Customer Servicing Occupations

Nature of Work

Workers in customer servicing jobs include those who read, install, test, and repair meters so that the utility companies can accurately charge each customer for his consumption of current. Also in this group are company agents in rural areas and appliance servicemen working in company-operated shops which repair electrical equipment owned by the customers.

Metermen (D. O. T. 5–83.456). Metermen are the most skilled workers in this group. They may install meters and frequently they test them, but their main job is to repair meters on company-owned property, such as those in powerplants and substations, as well as those on customers' premises. Some metermen can handle all types of meters, including the more complicated ones used in control operations of utility systems in industrial plants and in other places where large quantities of electric power are used. Others specialize in repairing the simpler kinds, like those used to record consumption in homes. Often, some of the large systems have meter specialists, such as *meter installers* (D. O. T. 5–83.450, .451) and *meter testers* (D. O. T. 5–83.452). Meter installers install and remove meters. Meter testers specialize in testing not only the small meters on homeowners' property but also the more complicated ones used in relay testing and control operations of the utility systems.

Meter Readers (D. O. T. 1–49.94). Meter readers go into homes, stores, and factories to read the consumption of electric current registered on the meter. They record the amount of current used in a certain period so that each customer can be billed for it. Meter readers watch for, and report, any tampering with the meter, power diversion, and other conditions affecting meters.

District Representative. Another occupation among the customer-servicing jobs is that of the district representatives. This job is unique in the industry since it includes the duties of several specialized workers. District representatives usually serve as company agents in outlying districts, in localities where the utility company does not have an office, and where the small number of customers does not justify the use of more specialized

Meters are tested periodically to make sure they are accurately measuring consumption of electricity.

workers. Their work includes reading meters, collecting overdue bills, connecting and disconnecting meters, and making minor repairs on them. They also receive complaints about service and reports of line trouble and transmit them to a central office for handling.

Appliance Servicemen (D. O. T. 5–83.041). Some electric utility companies employ appliance servicemen who install, repair, and service electrical appliances either in the company's shop or on the customers' premises. In a large city where many appliance servicemen are employed, they may specialize in servicing only one type of appliance; however, the companies generally require that the servicemen know how to fix many types of appliances.

Training, Other Qualifications, and Advancement

Metermen usually begin their jobs as helpers in the meter testing and meter repair departments. Young men entering this field should have a basic knowledge of electricity. About 4 years of on-the-job training is required to become a fully qualified meterman. Some companies have formal apprenticeship programs for this occupation in which the worker advances along well-defined lines of progression.

Utility companies usually employ inexperienced men to work as meter readers. They generally

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learn the job by accompanying the experienced meter reader on his rounds until they have learned the job well enough to go out on their rounds alone. This job can be learned in a relatively short time.

Employment Outlook

Slowly rising employment is expected in this field of work in the late 1950's and the 1960's. The many new customers who will be served by electric utilities will lead to an increasing number of meters in use and will result in some increase in the number of meter readers. There will be only a limited growth in the number of metermen because the new meters now being installed are better constructed and require much less maintenance than the earlier models. The need to replace workers who die, retire, or transfer to other fields of work will provide a small number of openings for new workers each year.

Earnings and Working Conditions

The earnings of workers in customer servicing jobs vary according to the type of job and the geographic location of employment. In mid-1956, top rates paid to metermen ranged from about \$2.30 to \$3.15 in the northeastern and midwestern sections of the country. Little information is available on wages of meter readers or appliance servicemen, but an examination of a few union contracts indicates that their hourly rates generally ranged from \$1.80 to \$2.25 in mid-1956.

The job of the meter reader is not physically hard, but he must walk all day and he must usually do a great deal of stair climbing. Metermen and appliance servicemen work indoors under typical repair shop conditions except when repairing or installing meters or appliances on customers' premises.

ELECTRONICS MANUFACTURING OCCUPATIONS

The Electronics Industry and Its Workers

Electronic manufacturing is one of our most dynamic and rapidly growing industries. Employment in the industry more than doubled between 1947 and 1956, and approximated 450,000 in late 1956. An additional 40,000 workers were engaged in the development and manufacture of electronic products in other industries, particularly those making aircraft and business machines.

Electronics products such as radio and television are found in nearly every home. Many other electronic products, less familiar to the average person, are widely used in manufacturing processes and commercial activities. Electronic products are also vital to the national defense. For example, electronic equipment is an integral part of every piloted aircraft, guided missile, and ship. It is essential to military communications, and it is the heart of the radar network set up to give warning in case of enemy air attack. Another important aspect of the industry is its large-scale research and product development activity which creates a constant flow of new and improved electronic products for home, industry, and defense.

The electronics industry provides job opportunities for persons with widely different levels of skill and education. Some jobs in the industry can be learned within a few weeks; others can be filled only by persons with university graduate training in science.

Nature and Location of the Industry

Before World War II, this industry was generally known as the radio industry. Its principal products were radios, broadcasting equipment, other receiving and transmitting equipment, parts, and electronic tubes. However, with the rapid development of other products in the general field of electronics, the broader term "electronics manufacturing" has come into general use. The electronics manufacturing industry consists of those plants engaged in producing electronic products or their components. The industry may be divided into four major product groups: (1) Radio and television sets and other consumer products; (2) military and industrial equipment; (3) electronic tubes; and (4) components such as capacitors and transformers.

Electronic products utilize the properties of electrons (very light, negatively charged particles) especially in vacuum or gas filled tubes or semiconductors. These tubes and semiconductors control a flow of electrons. Common examples of electron tubes are the tubes used in radio and television sets. Semiconductors, such as transistors, are the basic electronic components in some small radios and in many military products. Many electronic products either transmit radio waves through the air or receive them, e. g., broadcasting equipment, radios, radar, and navigational equipment. In other equipment, however, electrons are released and put to use by electron tubes within the equipment itself, e. g., electronic computers.

Household television and radio sets are the most widely used consumer electronic products. The industry produces other consumer products such as hearing aids, phonographs, high fidelity equipment, recorders, and electronic stoves. Another major group of products are electronic instruments for controls, counting, and inspection. In highly mechanized or automated plants, these electronic devices are used for the automatic control of machinery. In chemical processing plants, they are used for checking properties of liquids and gases, for flow control, and for measurement. Electronic computers are being applied in numerous industries. Two-way radio and commercial radar are other widely used industrial electronic products. Science also relies on electronic equipment. Many devices used by medical science and by many branches of physics are electronic. Electronic microscopes and electronic telescopes have been particularly valuable in expanding the frontiers of knowledge.

A great variety of electronic equipment is used in military products. Airborne electronic systems are essential for controlling guided missiles, aircraft flight control and navigation, communica-

tions, and weapons fire control. Radar, proximity fuses, and mine detectors are other important military products.

Some companies are engaged solely in producing radio and television tubes which they sell to other firms. Similarly, there are many plants which produce one or a few component parts which are used in other plants in the final assembly of electronic products.

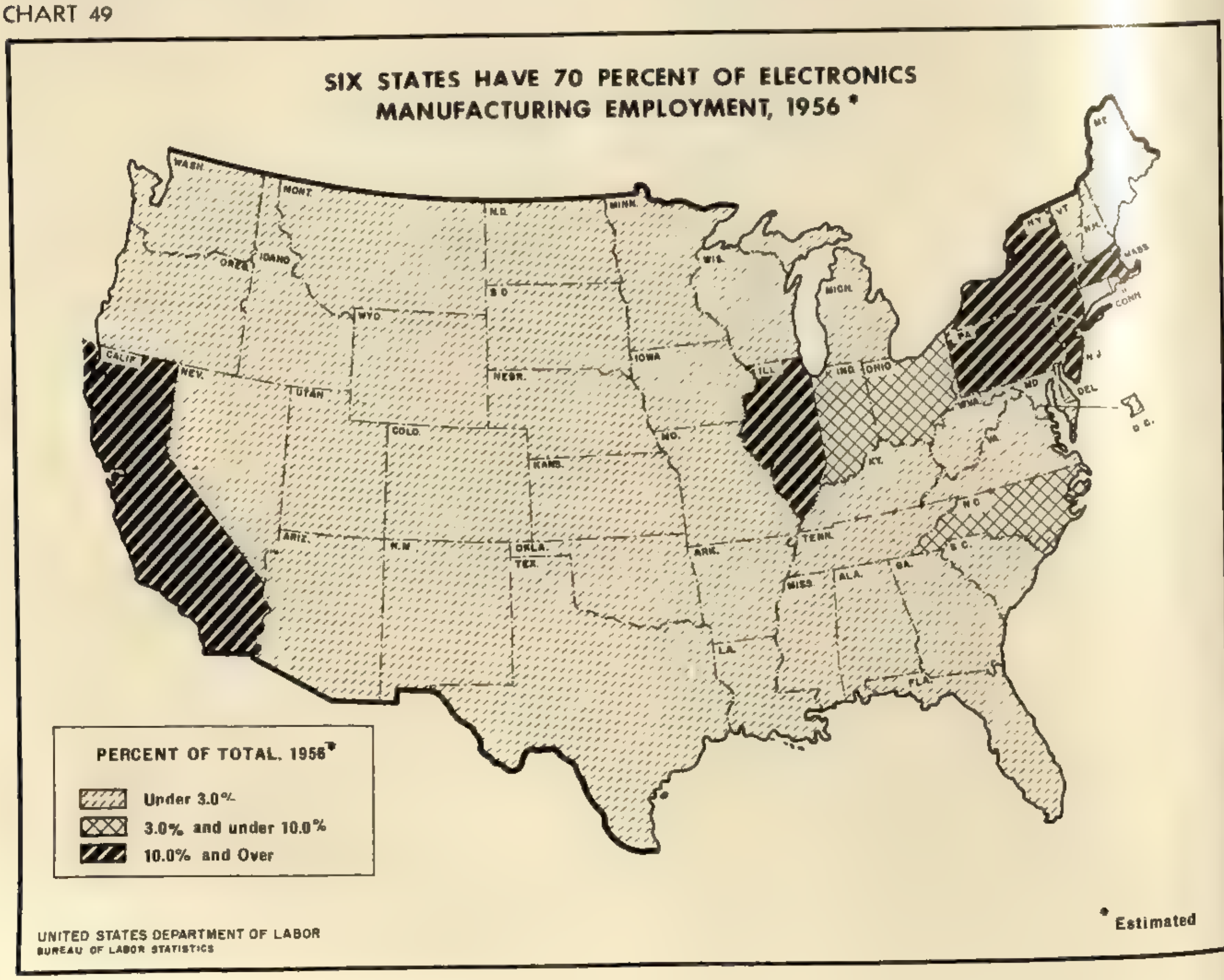
Electronics manufacturing plants are located in 24 States and the District of Columbia. The States with the largest number of electronic workers in late 1956 are shown in chart 49. These were California, Illinois, Massachusetts, New Jersey, Pennsylvania, and New York. The metropolitan areas with the highest concentrations of employment were Boston, Chicago, Los Angeles, New York, Paterson–Passaic, Philadelphia, and San Francisco. Many of the newer plants in this industry are located in suburban and rural areas.

How Electronic Products Are Made

The wide range of products manufactured and the considerable variation in production techniques make it difficult to generalize about the manufacturing process in this industry. Some companies produce most of the components they use, whereas others primarily assemble parts produced by other firms. The principal peacetime electronics products are mass produced. However, some complex specialized military and industrial equipment and components are made to order in small quantities.

Most plants in the industry specialize in manufacturing one type of end product such as television sets, radios, computers, guided missiles, or instruments, or one type of component such as resistors, antennas, capacitors, coils, or tuners. Even where plants do produce more than one kind of product, each product is generally produced by

CHART 49



separate departments and on separate assembly lines. Research and development are often kept apart from production, particularly in larger firms. Very often these activities are located at completely separate sites. When research and development and production are under one roof, they are often not closely connected, except in pilot stages of production where engineers are attempting to adapt the design of a product to quantity production.

Although electronic plants are primarily engaged in assembly, many of these plants have parts fabricating and processing departments. For example, many plants have machine shops, electroplating shops, sheet-metal shops, cleaning and coating sections, and wire fabricating departments.

The following is a brief description of the manufacturing methods used in producing radio and television receivers—major electronic products. Radio and television receivers are made on assembly lines where each worker rapidly performs a highly specialized task. All assembly operations are carefully timed to maintain a continuous production flow. The majority of receiver manufacturers purchase the parts and tubes used in the assembly operations from other manufacturers.

In general, receivers in various stages of completion move down the assembly line, which may be a continuous moving belt or simply a long bench upon which sets are pushed from one worker to another. The chassis (the metal frame to which most components are attached) is usually stamped out of sheet metal and some parts are riveted to it in a subassembly line. After the chassis is prepared, it starts down the main assembly line where other parts are attached, wired, and soldered. At frequent intervals, it is inspected and tested for proper assembly and electrical wiring. The periodic testing and inspection of a product to see if it is being made according to specifications are extremely important in electronics manufacturing and increase in frequency with the complexity of the product.

As the chassis moves down the assembly line, parts deliveries are timed to reach the assembler when needed. Small parts are often "hopper fed" into boxes by the side of the assemblers. Large parts move by overhead conveyor or are carted, depending upon the size of the plant or the quantity ordered. Some assemblers attach small parts, and others add wires or solder connections. Operations are subdivided as much as possible and workers are assisted by models, diagrams, and color coding of parts and wires. The degree of specialization depends upon the size of plant and type of product.

At the end of the line, tubes are added and the receiver is adjusted and tested as a unit. Inspectors and testers check its quality and, in some television firms, operate it for a while to see if defects develop. The production flow in a typical television manufacturing plant is illustrated in chart 50.

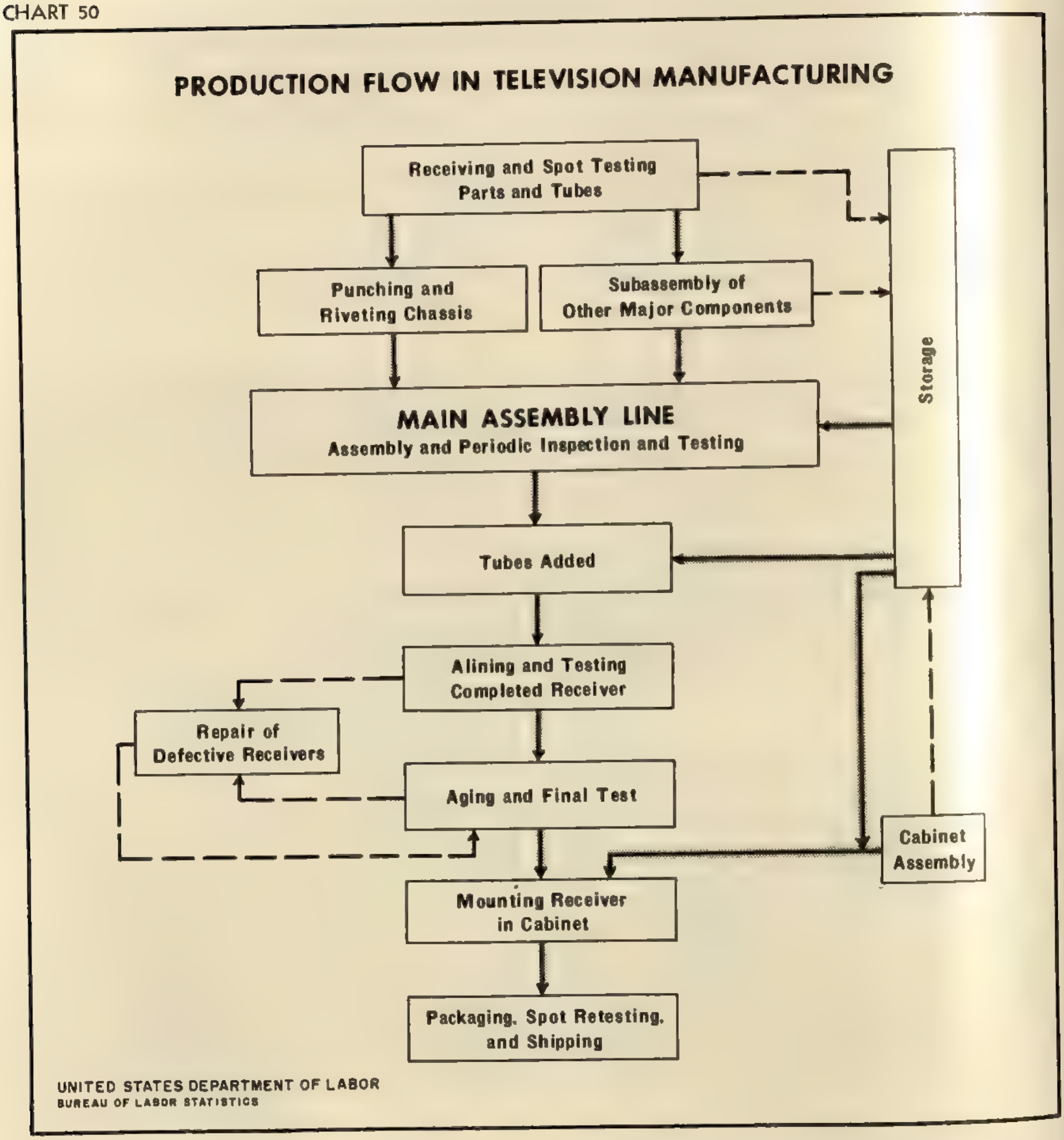
In many of the new plants making television sets, automatic assembly equipment and extensive conveyor systems are used. There is also a widespread use of printed circuits in the manufacture of television sets which eliminates much wiring and soldering and makes the insertion of parts quicker and easier. Although hand assembly is still typical of the industry, there is a growing trend toward the mechanization of assembly operations wherever large-scale production exists.

Electronic equipment more complex than receiver sets is produced in smaller quantities, with similar production techniques but with less mechanization and worker specialization as the unit volume declines. Large military and commercial units which are often very complex are broken down into subassemblies. These are built separately, inserted into a unit, and then tested. Many types of military equipment operate on extremely high frequencies where radio waves have properties similar to light waves. The electrical adjustment of such equipment is extremely critical and the equipment, therefore, requires precision manufacture. Some of the components associated with radar, such as metal waveguides, must be machined or cast with the greatest precision.

The assembling of military equipment is often quite different from the assembling of receivers. Assembly workers on military electronic products perform more operations and must be able to follow more detailed diagrams and instructions. Because accuracy is more important than speed, the work pace is not as rapid as in the assembling of receiver sets.

The manufacture of standards parts, such as capacitors, resistors, transformers, and coils is on a large-volume, mass-production basis, and usually involves relatively simple production processes.

CHART 50



Occupations in Electronics Manufacturing

As indicated previously, the industry employed persons with widely different skill and educational levels among its 450,000 workers in late 1956. In the industry as a whole, about 27 percent of the workers were employed in nonproduction jobs. Included in this group were professional and technical personnel, supervisory workers, and administrative and office employees. About a third of all nonproduction workers were employed in research and development activities. The proportion of nonproduction workers differs among the various sectors of the industry depending upon the type of product being manufactured and the amount of research and development work being carried on. For example, more than 30 percent of the workers in plants manufacturing military

products were nonproduction workers, whereas they constituted about 20 percent of the employees in radio and component parts plants.

Production workers comprised 73 percent of the industry's employment, as shown in the following tabulation which gives percentage distribution by major occupational groups of workers in the industry in March 1956. Asssembly workers, the largest occupational group in the industry, accounted for 30 percent of the industry's employment. Inspection and testing personnel made up about 14 percent of all workers; machining, 7 percent; and other fabricating, 6 percent.

Occupational group	*Percent of workers*
Total employment	100. 0
Nonproduction workers	26. 9
Managerial and supervisory	4. 4
Research and development	10. 0
Professional	4. 1
Technical	3. 0
Craftsmen	. 8
Other	2. 1
Other professional	2. 3
Office	9. 2
Accounting	2. 0
Other, including sales	7. 2
All other nonproduction workers	1. 0
Production workers	73. 1
Assembly	30. 5
Machining	7. 1
Other fabricating	5. 6
Processing (coating, plating, and cleaning)	2. 4
Inspection, testing, and related	13. 7
Materials handling	4. 1
Plant clerical	1. 3
Maintenance	3. 7
Custodial	2. 1
All other production workers	2. 6

About half of the industry's workers are women, most of whom are employed in semiskilled production jobs and office work. However, there are opportunities for women in nearly all types of positions. The proportion of women varies among the different manufacturing sectors of the industry. For example, women make up more than 60 percent of the employees in tube and components plants, whereas they comprise less than 45 percent of the employment in plants manufacturing military and industrial equipment.

Professional and Technical Occupations

A large proportion of professional and technical jobs are held by engineers. The industry also employs many scientists, draftsmen, and engineering aids. About 1 out of every 18 of the industry's employees is an engineer—a much higher proportion than is found in most other manufacturing industries. This is the result of the industry's emphasis on research and development. Most of the engineers in this industry are *electrical or electronic engineers* (D. O. T. 0–17.01). They are employed mainly in research and development work and in the preparation of technical manuals. Others are engaged in production engineering, quality control, or in sales or customer consulting jobs.

The industry also employs *mechanical engineers* (D. O. T. 0–19.01) who design machinery and equipment used in electronics manufacturing. *Industrial engineers* (D. O. T. 0–18.01) design jigs and fixtures, make time and motion studies, analyze costs, and determine production methods. *Ceramic engineers* (D. O. T. 0–15.11) are employed by firms which use ceramics in their products.

Among the scientists employed are *physicists* (D. O. T. 0–35.73), most of whom work in the development of military electronic equipment such as guided missiles and other airborne apparatus. *Chemists* (D. O. T. 0–07.80) are employed in electronic plants mainly in research and development and materials testing. Electronics manufacturing firms also employ *mathematicians* (D. O. T. 0–35.76), *industrial designers* (D. O. T. 0–46.88), and *metallurgists* (D. O. T. 0–14.20). Mathematicians work with engineers and physicists on complex mathematical problems. A few operate electronic computers. Industrial designers determine form and design of electronic products to make them more acceptable to consumers. Metallurgists are concerned with heat-treating problems and the properties of metals under stress and varying temperatures.

The industry employs several thousand employees in semiprofessional jobs to assist engineers and scientists. The largest group are *draftsmen* (D. O. T. 0–48.18) who are usually employed in engineering departments where they prepare drawings from sketches or specifications furnished by engineers. A higher proportion of draftsmen are required for military electronic production than for the manufacture of other types of electronic products.

Another important group of semiprofessional workers are the *engineering aids* who assist engi-

neers in research and development and in production planning by making calculations, tests, and rough drawings. They may also keep a check on pilot lot production and mockup (model) work. Aids frequently act as liaison men with other sections and departments.

Technical writers (D. O. T. 0–06.85) are employed mainly in plants making military and industrial products. The writers prepare technical manuals describing the operation and maintenance of complex equipment, and training manuals to be used by military personnel and employees of industrial customers. Technical writers also prepare catalogs and product literature, and project reports and proposals. They may search technical literature in connection with their writing. They work closely with engineers. (A detailed discussion of the duties, training, and employment outlook for engineers, scientists, and other technical personnel appears elsewhere in this Handbook. See index for page numbers.)

Administrative and Office Occupations

About 11 percent of the workers in the industry are employed in administrative and office jobs similar to those found in other manufacturing industries. More than half of these workers are women.

Included among the administrative workers are *accountants*, *purchasing agents*, *salesmen*, *personnel workers*, and *advertising personnel*. Thousands of other white-collar workers are needed to help the administrative workers. Some of these are *bookkeepers*, *secretaries*, *stenographers*, *clerks*, and *typists*. (Many of the individual office and administrative jobs are described elsewhere in this Handbook. See index for page numbers.)

Plant Occupations

Almost three-quarters of the workers in the electronics industry were employed in plant jobs in late 1956. Plant jobs can be conveniently classified into the following occupational groups: Assembly, machining and other fabricating, processing, inspection, maintenance, materials handling, plant clerical, and custodial. Some of the more important occupational groups are discussed below.

Assembly Jobs (D. O. T. 6–98.000 through .399; 7–00.000 through .099, and .901). Almost 1 out of every 3 electronic workers has an assembly job. Most of these jobs involve the performance of a single task. Some assemblers are engaged primarily in placing components in a chassis or other type of frame; others are engaged in connecting parts with electrical wires or in preparing parts for assembly. Most of these operations are performed manually with the help of a few handtools and perhaps some jigs for holding the work. In the mass production of television sets and similar products, printed circuits have made possible the use of automatic assembly equipment in the assembly process. Assemblers working on military and industrial electronic equipment are usually required to be more skilled than those who work in the manufacturing of radio and television sets.

An assembly worker installing a unit in a printed circuit board of a synchronizer for a radar warning system

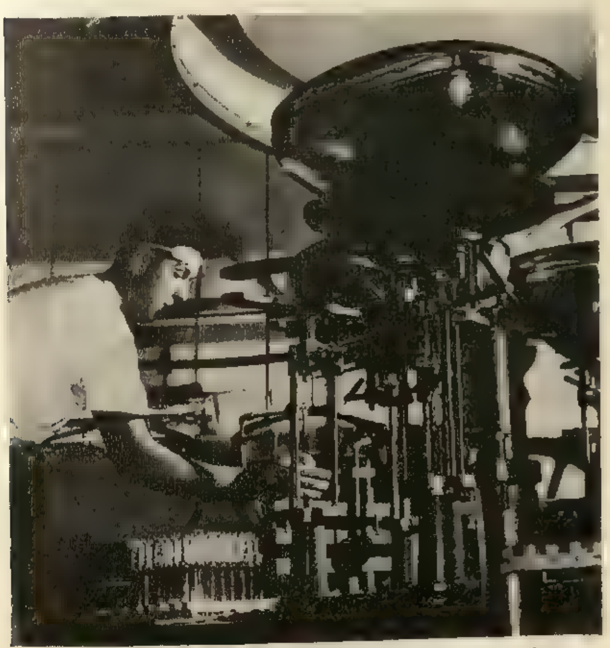
In manufacturing radio and television sets, assembly workers perform repetitive operations, such as fitting and securing transformers, condensers, and resistors into a chassis. Other assembly workers are employed as solderers to join electrical connections by melting and applying solder, and as wirers to make connections between wires and mechanical joints.

Precision assemblers employed in the manufacture of military and industrial electronic equipment assemble a wide variety of precision units and subassembly units where numerous interre-

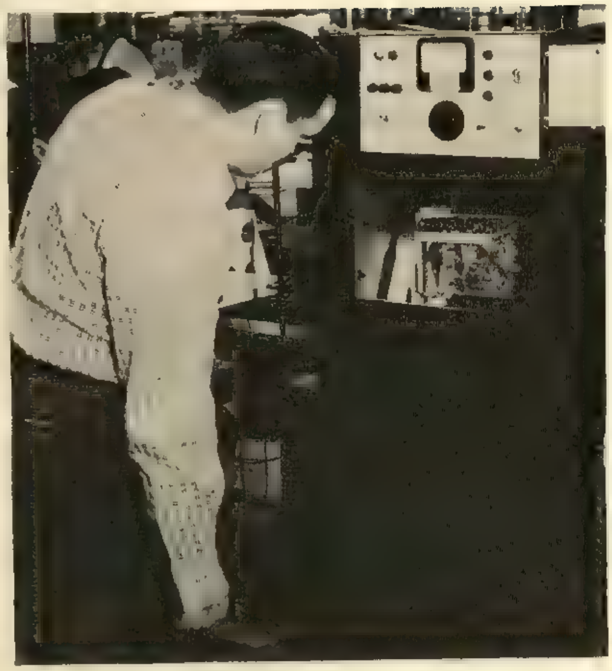
lated moving parts and mechanisms must operate within close tolerances. Experimental and developmental assemblers perform experimental and modification assembly, often from blueprints, sketches, or verbal instruction. Considerable independent judgment must be exercised in these assembly operations.

Most of the work in assembling television sets, radios, and military equipment produced in quantity is performed by women. In the mass production of electronic tubes and other electronic parts, nearly all assembly jobs are held by women. A larger proportion of men are used in the more technical assembly work which requires broader skill and experience. Practically all assembly of experimental or mockup models is performed by men. Men are also used for heavy assembly jobs.

Machining Occupations. About 7 percent of all employees in electronics manufacturing are engaged in metal machining jobs. Almost every large plant in the industry employs these workers. *Machine-tool operators* and *machinists* operate power-driven machine tools to produce metal parts of electronic components and equipment. *Toolmakers* construct and repair jigs, fixtures, and instruments used in electronics manufacturing. *Diemakers* specialize in making dies used in punch and power presses. (A detailed discussion of the duties, training, and employment opportunities in



The operator of this rotary sealing-in machine completes the assembly of television picture tubes.



Tester observing a control check being performed automatically on a subassembly.

individual machining occupations appears elsewhere in this Handbook. See index for page numbers.)

Inspection and Testing Occupations (D. O. T. 4–98.010 and 5–00.942). Electronic products are sensitive and finely adjusted instruments, and they must be inspected frequently during assembly and thoroughly tested before shipping. About 14 percent of all the industry's workers were working in inspection, testing, or quality control jobs in late 1956. Inspectors check incoming parts received from other plants or parts produced in their own plants with the aid of devices such as gages, to see whether the parts conform to specifications. Testers use electrical and electronic devices to check the performance of a product or component to make sure that it will do the job for which it was built. Final testing is one of the most important operations in the manufacture of electronics products and is done with special care for military products.

Most inspection and testing jobs are repetitive and require little skill. However, some of these jobs, particularly in final testing, require highly skilled workers. Some final testing of electronic end products is performed by electronic technicians.

Electronic Technicians (D. O. T. 5–83.444). Electronic technicians are skilled workers who work from wiring diagrams and blueprints and use the basic formulas, tables, charts, and manuals necessary for calculating circuit values. They also use testing and measuring devices, such as oscilloscopes, signal generators, and frequency meters. Many electronic technicians are employed as trouble shooters to locate the defective parts of electronic equipment. They also are employed as quality control inspectors, aliners, phasers, and in other skilled testing and inspection jobs. Many electronic technicians work in research departments or engineering laboratories where they assist engineers in the construction and testing of experimental models. They may also design and make specialized test equipment. (A more detailed discussion of electronic technicians appears elsewhere in this Handbook. See index for page numbers.)

Maintenance Occupations. Almost 4 percent of all electronic workers are skilled workers employed in the maintenance and repair of the large amounts of machinery and equipment used in electronics manufacturing plants. Included among the skilled maintenance workers are *electricans*, *carpenters*, *industrial machinery repairmen*, *painters*, *millwrights*, and *pipefitters*.

Other Plant Jobs. The electronics industry employs many other plant workers to fabricate and process parts, to move materials, to receive and ship materials, and to keep plant records. In addition, the industry employs *guards*, *janitors*, and *laborers*.

Training and Other Qualifications

Because of the technical nature of its operations and great emphasis on research and developmental work, the electronics industry requires many engineers and other technical workers. As indicated in the statements on individual occupations, a bachelor's degree in engineering from a recognized college is usually the minimum educational requirement for engineering jobs. Requirements for technical writers include a combination of writing ability and an engineering or science background. Although many technical writing jobs are filled by electrical engineers, individuals with English or journalism majors, and some training or experience in scientific fields, are also employed as technical writers. Several different avenues may lead to jobs as draftsmen in this industry. Some workers enter this occupation after studying at a trade school or technical institute; others learn the skills of the occupation by serving a 3- or 4-year apprenticeship, or through an informal arrangement combining on-the-job training and part-time schooling. (The training and other qualifications generally required for individual scientific and technical occupations are described in detail elsewhere in this Handbook. See index for page numbers.)

Electronic firms generally have the same requirements for filling clerical and administrative jobs as firms in other industries. Most electronic firms require commercial courses in high school or business school for office jobs such as clerks, bookkeepers, stenographers, and typists. More and more employers in this industry require college training for jobs in advertising, personnel, accounting, and other administrative jobs. (Refer to index for page numbers of statements on general requirements in specific occupations.

The training requirements for plant jobs range from a few weeks of on-the-job experience to 4 or 5 years of formal apprenticeship. Persons with no previous experience or training are hired for the great bulk of repetitive assembly jobs. The assembly jobs requiring greater skill are generally filled by persons who have had several years of experience in less skilled electronics assembly work. Finger dexterity, steady hands, and good eyesight are required for assembly jobs.

As in the case of assemblers, persons with no previous experience or training are hired for routine testing and inspection jobs. Some of the more difficult testing and inspection jobs are filled by electronic technicians. Some final testers are required to hold a license from the Federal Communications Commission as first- or second-class commercial radiotelephone operators.

Electronic technicians employed in testing jobs must be familiar with basic electronics theory, with circuits, and with the functions of many electronic components. Workers may enter this occupation in several ways. Some are upgraded to this job from lesser skilled jobs in which they acquire a broad knowledge of and experience in electronics. They may also have had some classroom training in electronics theory and practice to sup-

plement their experience. Other workers have learned this occupation in technical institutes or trade schools. In recent years, training received in Armed Forces technical schools has helped many men qualify for civilian electronic technician jobs after leaving the service. Another method of entering the occupation is to serve a 4- or 5-year apprenticeship.

A 3- or 4-year apprenticeship, or its equivalent in experience, is generally required for skilled machining jobs such as machinist or tool and die maker, and for skilled maintenance trades such as electricians, millwrights, and industrial machinery repairmen. (Refer to index for page numbers of statements on general requirements in these skilled occupations.)

Employment Outlook

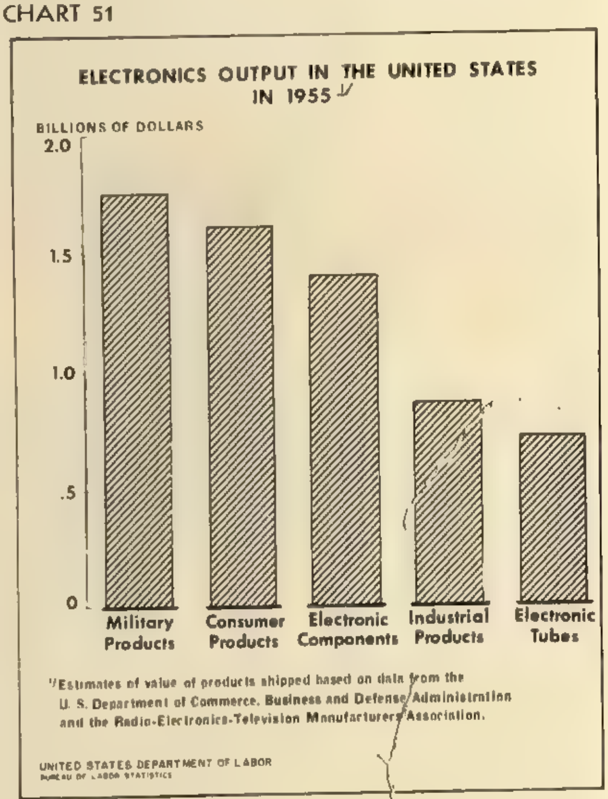
The electronics industry will provide thousands of job opportunities for new workers in the late 1950's and the 1960's. This is expected to be one of the fastest growing manufacturing industries, and employment will increase at a much faster rate than the Nation's total labor force.

From inconspicuous beginnings shortly after the opening of the 20th century, electronics has grown into one of the Nation's giant manufacturing industries. Employment in this industry began its rapid growth in the 1920's, when millions of radios were purchased as commercial radio broadcasting spread throughout the country. During the depression years, employment dropped briefly, but by the midthirties it reached a new high. The need of the Armed Forces for electronic equipment brought about a tremendous expansion in the industry during World War II. At the peak of the war in 1944, about 380,000 wage and salary workers were employed, primarily in plants manufacturing military electronic equipment and components.

Employment dropped sharply after the end of World War II, when military requirements for electronic equipment were greatly reduced. As electronics manufacturers shifted to the production of civilian items, employment again rose. Since World War II, the trend of employment in this industry has generally been sharply upward, although the industry has experienced significant fluctuations in its level of activity. This postwar growth reflects new applications of electronics in consumer goods and industrial and military equipment. Television sets, electronic computers, electronic controls for industrial processes, and airborne electronic systems are some of the new products which have spearheaded the growth of the industry in recent years.

Continued rapid expansion in the industry can be expected during the late 1950's and the 1960's. All segments of the industry are expected to participate in the growth. Chart 51 indicates the distribution by industry sector of the more than $6 billion in products shipped by the industry in 1955. An important factor influencing the growth of this industry is its constant emphasis upon research and development. Many new and improved electronic products for industrial consumers and for the military are expected to result from the industry's research activities.

CHART 51



The greater use of electronic products in manufacturing and commercial establishments offers the most promise for expansion. Substantial increase in the use of electronic control equipment is expected in metalworking, in chemical and petroleum processing, and in many other manufacturing activities. Greater use of electronic equipment is anticipated for communication and navi-

gation purposes in aircraft, ships, railroads, and trucking. Indications are that data-processing equipment, which in 1956 represented only a small percentage of industrial and commercial electronics output, will grow rapidly and become one of the industry's important products.

In 1956, the bulk of sales of electronic products to consumers consisted of television and radio sets, and it is likely that they will be the principal consumer products of the industry in the 1960's. However, the increased use of other electronic products already in use, and the development of new products will greatly expand the output of consumer electronic items. Some products which are expected to provide substantial future sales for the electronics industry are automobile equipment; cooking equipment; refrigerators; air conditioners and heaters; intercom and high fidelity systems; and lighting.

More than 40 percent of the industry's income in 1955 was from activities relating to national defense. This included both production of military items and research and development contracts. Military appropriations are affected by international relations and it is, therefore, difficult to make any long-range projections for these expenditures. However, the dollar volume of military expenditures has risen over a period of years, and indications point to a continuation of this long-term growth. Furthermore, expenditures for electronics, as a percentage of total military expenditures, are expected to increase. The increased output of guided missiles, which use a large volume of electronic components and controls, the growing amount of electronic equipment in aircraft, and the expansion of radar systems are factors which will stimulate this segment of the industry's growth.

The greatly increased volume of output, as indicated above, will result in a continued rapid rise of employment in the industry. Employment will not increase nearly as much as output, because technological improvements are enabling the industry to produce greater amounts of equipment per worker employed. Mechanization of processes, simplification of design, adoption of standard parts, and construction of new plants with better layouts are among the factors increasing productivity.

There will be some differences in the rates of growth among the various occupational groups employed in this industry. The growing volume of research and development and the greater application of scientific principles to production processes will result in a relatively larger growth among technical personnel such as engineers, draftsmen, and engineering technicians. The need to maintain and repair the growing amount of machinery and equipment which will be used in this industry will also result in a relatively larger growth in skilled maintenance occupations. However, the number of semiskilled assembly and inspection employees will increase at a slower rate than total employment in the industry.

In addition to job opportunities resulting from the growth of the industry, thousands of job openings will be created each year by the need to replace workers who die, retire, leave the labor force temporarily, or transfer to other industries. This industry has a relatively high turnover rate, due, in part, to the fact that women make up a large proportion of the industry's work force.

Earnings and Working Conditions

Production workers in electronics manufacturing plants (except those employed in manufacturing radio tubes) earned an average of $72.83 a week and $1.83 an hour in July 1956. This compares with average weekly earnings of $79 and average hourly earnings of $1.97 for production workers in all manufacturing industries in the same month. The relatively lower average earnings of workers in the electronics industry reflects the large proportion of semiskilled assembly and inspection workers. Skilled workers in electronics manufacturing usually receive the prevailing wage for their particular trade in the area in which they work.

Information collected from a number of large employers indicates the general range of earnings for selected plant occupations in mid-1956 were:

Assemblers, semiskilled	$1.35–$1.80
Assemblers, precision	$1.80–$2.30
Machinists	$2.10–$2.80
Tool and die makers	$2.30–$3.10
Instrument makers	$2.50–$2.80
Inspection and testing occupations	$1.50–$2.90

Little information is available on the earnings of professional and technical personnel in this industry. (Data on the earnings of individual professional and skilled occupations in industry as a whole are given elsewhere in this Handbook. See index for page numbers.)

Most workers in the industry receive 2 or 3 weeks' vacation with pay, depending on their length of service. The majority of firms give their employees 6 or 7 paid holidays a year. Almost all electronic workers are covered by both death benefit and sickness insurance plans.

Working conditions in electronics manufacturing compare favorably with those in other industries. Plants are generaly clean, well lighted, and relatively free from noise. The work in most electronic occupations is not strenuous. However, the assembly line operations require speed, and the continual repetition of many small tasks creates monotony. Employers make an effort to help relieve this monotony by frequent rest periods. Cafeterias, recreational facilities, and social programs are also provided for employees, and some plants provide music during working hours.

Injuries in electronics manufacturing are less frequent and less severe than those in manufacturing as a whole. Shock from high voltages is the most serious hazard, but few workers are required to work with high voltages. Burns from soldering irons, cuts, bruises, punctured fingers, and similar minor injuries are more common hazards.

Many of the workers in this industry are employed in unionized plants and are covered by collective bargaining agreements. The principal unions in the industry are the International Union of Electrical, Radio and Machine Workers; International Brotherhood of Electrical Workers; International Association of Machinists; and the United Electrical, Radio and Machine Workers of America (Ind.).

HOTEL OCCUPATIONS

The Hotel Business and Its Workers

Everywhere people travel in the United States, whether for business or pleasure, they find hotels and motels ready to cater to their comfort. The gigantic business of providing a "home-away-from-home" is a source of employment for a great number of workers who serve travelers in cities and towns, along highways, and in remote resort areas in every section of the country.

Rooms for guests and restaurant facilities represent the chief services provided by hotels and motels. Large city hotels also feature banquet rooms, exhibit halls, and spacious ballrooms—to accommodate conventions, business meetings, and social gatherings. Many large hotels employ professional entertainers and have recreational and entertainment facilities such as swimming pools and roof gardens. In addition, most hotels will provide guests with information about interesting places to visit in the vicinity, sell them tickets to theaters or sporting events, and, if necessary, make arrangements for babysitting services. For the convenience of guests, there are newsstands, gift shops, barber and beauty shops, and valet and laundry service. Today, the fast growing motel business, which primarily attracts automobile travelers, is also increasing the types of services offered.

Approximately half a million people (excluding proprietors) were employed in 1956 in hotels, motels, and related businesses. Approximately 80 percent of these workers were employed in the Nation's 25,000 hotels; less than 10 percent were in the substantially larger number of motels. The remainder were in related businesses, such as summer camps, dude ranches, and rooming and boarding houses. About half of all the employees in hotels and related businesses were women.

Many hotel workers are in occupations which require a minimum of training. However, the demand is increasing for specially trained people in many departments. Hotels are complex organizations and need experienced personnel who know the business "from the ground up"—to direct and coordinate operations which may involve thousands of guests annually and millions of dollars worth of property and equipment.

This chapter deals with employment opportunities in both hotels and motels. Following the introductory sections, which give an overall view of the hotel (and motel) industry and its workers, are separate statements on several occupations unique to hotel operations.

Nature and Location of Business

Hotels are of three main types—commercial (transient), residential, and resort. Commercial and residential hotels operate all year round, whereas resort hotels are generally seasonal in nature and may be open only a few months during the year. The vast majority of hotels are commercial ones, which cater mainly to travelers seeking a room for a brief stay, often for only 1 night. In contrast, residential hotels chiefly accommodate people for long periods, ranging from a few months to many years. Resort hotels primarily provide lodgings and recreational facilities for people on vacations. Motels (also referred to as auto courts, motor courts, and tourist cabins) provide lodgings chiefly to automobile travelers.

Hotels range from modest 2- or 3-story establishments to towering buildings covering large areas. The smallest commercial and residential establishments have fewer than 25 rooms and only a few employees. The largest have 1,000 or more rooms and may employ as many workers as there are rooms; less than 2 percent have 500 or more rooms. Resort hotels range from the small "family-operated" type to those employing several hundred workers (often college students) for a few weeks or months during the year. Motels are typically small. Most of them have between 15 and 20 rooms and employ, on the average, only 1 paid worker per establishment; a small proportion have 40 or more rooms. Many motels are of the "mom-and-pop" type—run by the owners, frequently without any paid help.

About 80 percent of the hotels have restaurants, ranging from simple coffee shops to vast dining

and banquet rooms with wine cellars and elaborate kitchens. The hotel industry obtains about the same amount of income from sales of food and beverages as from room rentals. Relatively few motels have eating facilities, although a growing number of deluxe ones are being built which include restaurants.

Hotel workers are employed in cities of all sizes and in resort areas. However, by far the greatest numbers are in the large urban centers of the most populous States. Approximately one-third of all hotel employees in 1954 were in 3 States—New York, California, and Illinois. Motels are widely scattered, mainly along major highways throughout the country, but with some concentrations on the outskirts of large cities. Only 8 States had as many as 1,000 motel employees in 1954. However, Texas and California each with nearly 4,000 employees and Florida with approximately 3,000 accounted for nearly 30 percent of all motel workers.

Hotel Occupations

Hotel work involves the largest housekeeping operation in the business world. Many thousands of maids, porters, housemen, linen room attendants, and laundry room workers are employed in the housekeeping departments of the Nation's hotels. These employees work in "back of the house"—making beds, cleaning rooms and halls, moving furniture, hanging drapes, providing guests with fresh linens and towels, operating laundry equipment, and marking and inspecting laundered items. Women are usually employed for the lighter housekeeping tasks, whereas men do jobs requiring more strenuous physical effort, such as washing walls and arranging furniture. Hotels usually employ housekeepers to supervise these workers, and large hotels may also have a special manager in charge of laundry operations.

Food preparation and service is another large hotel department. Hotels employ many kitchen workers ranging from unskilled dishwashers and vegetable peelers to highly skilled cooks and chefs. Many thousands of waiters and waitresses are also required to serve meals in hotel coffee shops and dining rooms. (See chapter on Restaurant Occupations.)

A uniformed staff performs services "up front" in the hotel lobby. This staff includes the bellmen who, directed by bell captains, carry baggage for guests and escort them to their rooms. Elevator operators and doormen are also a part of the uniformed staff; these types of workers, like many others in hotels, are employed in other industries.

The "front-office" staff, most of whom are men, work in hotel lobbies as room clerks, key clerks, mail clerks, and information clerks. Their chief duties are to greet guests, assign rooms, and furnish information. Perhaps half of all hotel clerical workers are front-office employees. The remainder of the clerical workers, mainly women, are employed in a variety of office occupations—as bookkeepers, who may operate office machines especially designed for hotel work; as cashiers, who total hotel bills and receive payments when guests check out; as telephone operators; and as secretaries, stenographers, and typists. In 1950, about 10 percent of all hotel employees were clerical workers.

Managers and their assistants are the executives responsible for supervising hotel operations and making them a profitable business. They are a small group, compared to the total number of hotel workers, comprising only about 5 percent of all hotel employees in 1950. However, this figure does not include the many hotel and motel proprietors who either manage or assist in managing their own establishments. It also excludes housekeepers, although in the largest hotels the head housekeepers have a great deal of administrative responsibility. The executive in overall charge of hotel operations is the general manager. Sometimes general managers have executive assistants who may be in charge of the front office and may also assist in various phases of hotel management. Some assistants may be responsible for specific operations; they may be, for example, food-service managers who run the dining rooms and other eating facilities, or sales managers responsible for attracting more business to the hotel.

In addition to the occupations mentioned above, hotels have numerous other types of workers who are also found in other industries. Among these are a few thousand accountants and auditors, personnel workers, musicians and entertainers, and recreational workers; these and other professional workers and specialists comprise about 2 percent of all hotel employees. Another and probably larger group is composed of maintenance workers such as carpenters, electricians, stationary engi-

neers, plumbers, and painters. Still other types of workers employed in hotels include detectives, barbers, beauty operators, valets, tailors, seamstresses, and gardeners. (See index for separate statements on many of these and other occupations found both in hotels and other industries.)

Employment Outlook

Many thousands of openings will arise in the hotel business each year, continuing into the 1960's. Most openings will be in the large relatively unskilled occupations—such as maid, porter, houseman, kitchen helper, waiter, and waitress—where turnover rates are high. Turnover in these jobs will remain high as long as favorable economic conditions continue and workers find it easy to shift to other types of employment; another factor responsible for the high turnover rates is that many of the jobs are filled by women who leave after a short period of employment to assume family responsibilities. A number of young people will also be needed as replacements in "front-office" jobs, in which vacancies arise partly because some clerks advance to managerial posts. There will continue to be good opportunities for young people who acquire the training and experience necessary to qualify for jobs as cooks, chefs, and food managers. (See chapter on Restaurant Occupations.) Furthermore, employment opportunities for thousands of students and other temporary workers will become available each year in a variety of occupations in resort hotels.

Some new jobs will result from the moderate growth anticipated in the hotel and motel fields through the early 1960's. However, employment in motels is expected to continue to grow at a faster rate than employment in hotels. Hotel employment, which had dropped sharply in the 1930's, expanded considerably with the upsurge of travel during World War II; in those years, motel competition was not an important factor. Following the mid-1940's, there was a decrease in hotel employment which was largely offset by an increase in the number of workers in motels; motel employment rose by approximately 20,000 from 1948 to 1954. Great stimulus will be given to the building of motels, and to a lesser extent of hotels by the $36 billion Federal highway building program which was begun in 1956. A growing number of large, luxury-type motels will be built (some by hotel and restaurant chains), and these will include restaurant facilities and offer many hotel-type services which will require relatively large numbers of workers. Newly created jobs resulting from motel growth will be mostly in service occupations, such as maid and porter, or in food preparation and food-service jobs. A few opportunities will also arise for managers.

At the same time motels are expanding their facilities, services, and employment, hotels are taking measures to meet this competition. Some new hotels are being built; however, most of the increase in employment expected in hotels will result from the greater number of rooms that will be provided by additions to existing hotels. Business will be stimulated by modernization programs including television and air-conditioning installations, redecoration and expansion of large public rooms, and the use of innovations such as closed-circuit television which enables members of business and other organizations to gather in different hotels and simultaneously conduct their affairs. Other methods being used to promote hotel business include issuing credit cards, which allow travelers to charge hotel expenses; use of referral systems whereby a hotel unable to furnish guests with accommodations will arrange for rooms in other hotels; reduced rates for families; a de-emphasis on formality through the use of hotel drive-in entrances; increased parking facilities (often in the hotel building); and greater effort by hotels to "sell" themselves through intensive publicity, employment of sales managers, or cooperation with local groups in community promotional programs.

In the long run, such factors as rising population and income, and increased travel for business and pleasure are expected to result in a continued slow rise in hotel and motel occupations. Employment in these occupations is not likely to be greatly affected by technological developments, although some workers—particularly in the least skilled service occupations—may be displaced by improved equipment. For example, the expanding use of self-service elevators will result in the continuing displacement of elevator operators, and the widespread use of equipment such as automatic dishwashers and vegetable cutters and peelers will reduce the need for kitchen helpers. Improved laundry equipment, such as that which folds towels and linens, may also become more

generally used. In addition, improvements in office machines may displace some clerical employees.

Employment in hotels and motels is closely related to economic conditions which affect travel. Jobs, such as maid and bellman, in which the largest proportions of hotel workers are employed are the ones which have, in the past, been most affected by economic downturns. Some groups of workers—bell captains, head housekeepers, and managers—have had relatively stable employment.

Earnings and Working Conditions

Hotel workers' earnings depend not only on their occupations but also on the location, size, and type of the hotel. These factors, largely determine both the workers' wages and the amount received in tips—a major part of the earnings for many hotel workers, including bellmen, waiters, and waitresses.

Data on earnings in hotel occupations in which tips are a relatively unimportant part of total income are available from a survey covering 19 large cities. The survey shows that of the occupational groups covered, maids typically receive the lowest pay and room clerks, the highest. Women employed as maids averaged less than $1 an hour in 1955 in 14 of the 19 cities surveyed. (See table.) Citywide averages for maids ranged from 40 cents or less an hour in 4 southern cities to $1.27 in San Francisco. Average earnings for housemen and lobby cleaners were lowest (about 50 cents an hour) in some southern cities and highest (about $1.35) in 2 West Coast cities. In most cities, elevator operators (both men and women) had approximately the same average earnings as housemen or lobby cleaners.

Average hourly earnings of men room clerks ranged from $1.12 in Kansas City to $1.77 in San Francisco. The relatively few women room clerks had somewhat lower wages, on the average, than

Average straight-time hourly earnings [1] of men and women in selected occupations in hotels, 19 cities, summer 1955

Region and city	Maids	Elevator operators		Housemen	Cleaners, lobby	Clerks, room	
		Men	Women			Men	Women
New England:							
Boston	$0.91	$0.96	--------	$0.97	$0.97	$1.29	--------
Springfield–Holyoke	.93	.91	$0.87	.92	--------	1.44	--------
Middle Atlantic:							
Buffalo	.93	.87	.92	1.01	.[illegible]7	1.33	$1.18
New York City	1.00	1.22	1.23	1.23	1.[illegible]0	1.60	1.50
Philadelphia	.80	.85	.87	.91	.[illegible]2	1.48	1.29
Pittsburgh	1.16	--------	1.21	1.22	1.21	1.44	1.40
Washington, D. C.	.79	.82	.85	.84	.88	1.29	--------
Southeast:							
Atlanta	.36	--------	.40	.56	.55	1.35	--------
Birmingham	.31	--------	.31	--------	.47	1.18	--------
Great Lakes:							
Chicago	.92	1.13	1.16	1.07	1.16	1.57	1.24
Cincinnati	.89	--------	.97	.96	.98	1.42	--------
Cleveland	.91	--------	.94	.96	.99	1.26	1.24
Minneapolis	1.01	1.09	1.08	1.15	1.10	1.20	--------
Middle West: Kansas City	.74	.78	.77	.79	.80	1.12	1.13
Southwest:							
Houston	.40	.48	.61	.52	.54	1.33	1.17
New Orleans	.37	.53	--------	.58	.53	1.20	--------
Pacific:							
Los Angeles	.95	1.03	1.03	1.05	1.13	1.34	--------
San Francisco	1.27	1.33	1.33	1.33	1.33	1.77	--------
Seattle	1.19	1.28	1.28	1.31	1.37	1.63	--------

[1] Excludes premium pay for overtime and for work on weekends, holidays, and late shifts, as well as the value of tips and free meals and lodging provided to some employees.

men clerks. Key, mail, and information clerks are usually paid lower salaries than room clerks.

Since earnings of bellmen are greatly affected by the tips they receive, it is difficult to obtain meaningful data on their income. For example, bellmen in New York City received salaries of about $20 to $25 a week, but, with tips, earnings were probably at least double these amounts. In large hotels and in resort areas, bellmen may earn $100 a week or more (including tips).

Wide differences exist in the salaries of managers, executive housekeepers, and other supervisory workers, mainly because the duties and responsibilities in each of these occupations vary so greatly by size and type of hotel. Average annual salaries of housekeepers in executive posts typically ranged from $3,600 to $8,000 in 1956. In addition, their lodging in the hotel, meals, laundry, and other services are usually furnished. Salaries under $3,000 a year are received by many working housekeepers who supervise few people and spend a large part of their time cleaning rooms and performing related work.

Management trainees who graduated from one of the few colleges which offer specialized hotel management programs received beginning salaries of $3,600 or more in 1956. Increases are usually given trainees periodically for the first year or two, and thereafter may be granted as they are shifted to positions involving greater responsibility. A recent survey made by a large specialized college indicated that average managerial salaries were between $12,000 and $15,000 a year for a group that had graduated more than 10 years ago with a major in hotel management. Managers, with varying amounts of experience, employed by one large hotel chain received salaries ranging from $6,000 to $15,000 in 1956. In addition to salary, hotels customarily furnish managers and their families with lodging in the hotel, meals, parking facilities, laundry, and other services.

Hotel employees usually worked a 40-hour week in northern cities and a 48-hour week in southern cities, according to a 1955 survey in 19 large cities. Workers in a few cities had 37½-hour weekly schedules. Since hotels are open round the clock, workers may be employed on any 1 of 3 shifts, beginning early in the morning or in midafternoon or at midnight. Staffs are usually smaller on night than on day shifts, and additional compensation may be paid for work during late hours. Managers and housekeepers who live in the hotel usually have regular work schedules but may be on call 24 hours a day, 7 days a week.

Cooks, pantry workers, dishwashers, and other kitchen help commonly receive 2 free meals a day; in a few hotels, maids, elevator operators, and room clerks also receive free meals while on duty. A large majority of workers in 19 cities received a week's vacation with pay after 1 year of service and 2 weeks after 3 or more years. Paid holidays most commonly ranged from 2 to 6 days in mid-1955. Life insurance, hospitalization, and surgical insurance plans, financed partly by employers, are frequently provided hotel workers.

The Hotel and Restaurant Employees and Bartenders International Union is the major union in the hotel business. Uniformed staff, such as bellmen and elevator operators, may be members of the Building Service Employees International Union.

Where To Go for More Information

Information on jobs in hotels may be obtained directly from personnel departments of hotels.

Information on career-type positions in hotels may be obtained from:

American Hotel Association,
221 West 57th St., New York 19, N. Y.

Additional information on training opportunities in the hotel field may be obtained by writing to:

The National Council on Hotel and Restaurant Education, P. O. Box 7727, Benjamin Franklin Station, Washington 4, D. C.

Information on housekeeping in hotels, including a list of schools offering courses in housekeeping, may be obtained from:

National Executive Housekeepers Association,
The Brown Palace Hotel, Denver 2, Colo.

High school students—or adults interested in evening courses—may obtain information on courses relating to hotel work by writing to the local Director of Vocational Education, the Superintendent of Schools in their local community, or the State Director of Vocational Education in the Department of Education in the State capital.

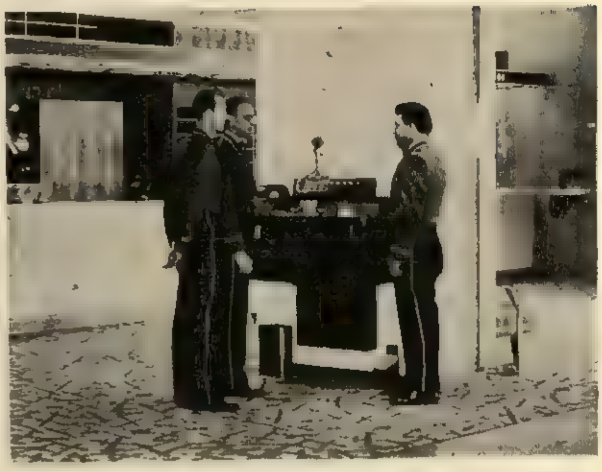
Bellmen and Bell Captains

(D. O. T. 2–22.11; 2–22.01)

Nature of Work

Bellmen, also called bellboys or bellhops, carry baggage for hotel guests and perform a variety of other services for them. After a guest has registered, a bellman obtains the room key, takes the guest to his room, and deposits his baggage. The bellman checks the lights and the supply of towels and soap, and sees that everything is in order in the room. He may suggest the use of various hotel services, including the dining room and the valet service. Bellmen also deliver packages and perform other errands for guests. In large hotels, special baggage porters are usually employed to carry baggage for guests who are checking out. In smaller hotels, bellmen carry baggage for outgoing as well as incoming guests and may also relieve the elevator operator or switchboard operator.

Bell captains are employed in large hotels and many medium-size ones, to supervise the bellmen. They assign work to these employees, keep their time records, instruct new bellmen in their duties, and may also interview job applicants. In addition, they handle complaints from guests regarding the work of their department, and take care of unusual requests for service. They may also help guests arrange for transportation by giving them information on train and plane schedules and may arrange for a baggage porter or a bellman to pick up the transportation tickets. At times, bell captains may also perform the duties of bellmen.



Bell captain instructing bellmen.

Training and Other Qualifications

Bellman jobs are filled, in many hotels, either by promoting men employed as elevator operators or by hiring experienced bellmen from the outside. Some hotels, particularly the smaller ones and resort hotels, hire inexperienced young men as bellmen.

Young men seeking work as bellmen may apply to personnel departments of hotels in their own community, where their knowledge of the local area will be helpful in giving guests information. Applicants are often referred to bell captains for an interview. Work and character references of job applicants are carefully checked prior to hiring. Since bellmen are in frequent contact with the public and have access to their personal belongings, it is important that they be honest, neat, tactful, and courteous. They must also have the stamina to be on their feet all day and to carry heavy baggage.

No specific educational requirements exist for bellman jobs. However, courses covering bellman work, which are offered by a small but growing number of trade and vocational schools, are generally helpful in obtaining jobs. Graduation from high school is also valuable because outstanding bellmen with this educational background may be transferred to front-office clerical jobs, which offer better opportunities for promotion. (See statement on front-office clerks.)

In the service department of the hotel, the line of promotion is from bellman to bell captain to superintendent of service. Some of the factors which may affect a bellman's chances for advancement are a favorable work record showing a minimum of complaints by guests, good work habits, and leadership qualities necessary in supervisory positions. Since only one bell captain's position exists in a hotel, it may take a number of years before an opening occurs. A limited number of opportunities also exist for advancement to the position of superintendent of service. Men in this job—which is found in only a few hotels with large service departments—supervise elevator operators and starters, doormen, and washroom attendants, as well as bellmen.

Employment Outlook

A few thousand openings for bellmen are expected each year, continuing into the early 1960's. Most of these openings will arise from turnover, primarily because of the need to replace students and other young men who do not plan to remain bellmen for a long period of time and who will find it fairly easy to obtain other jobs as long as economic conditions remain favorable. Since a promotion-from-within policy is followed by many hotels in advancing elevator operators to bellmen, chances for outsiders to enter bellman jobs will be best in resort hotels, in hotels which employ women as elevator operators, and in the increasing number of hotels with automatic elevator installations. Vacancies for beginners will also arise in small hotels, as experienced bellmen shift to jobs in better hotels where earnings from tips may be higher. In general, employers reported little difficulty in filling jobs for bellmen in 1956. Competition among employed bellmen for the relatively few bell captain jobs that will become available in the future is expected to remain keen.

Only slight growth in employment of bellmen is likely in the long run. Some jobs will arise in the small number of new hotels that will be built and from additions to existing hotels. The fast growing motel field will also provide some new jobs; however, because of the type of construction and the emphasis on informality, motels require relatively few bellmen.

(See introductory section to this chapter for information on where employed, earnings and working conditions, where to obtain further information, and for additional information on employment outlook.)

Front-Office Clerks

(D. O. T. 1–07.)

Nature of Work

Most hotels employ one or more front-office clerks whose chief duties are to greet guests, rent rooms, handle mail, and perform other duties related to the assignment of rooms. Working "up front" in hotel lobbies, they deal directly with the public and help build a hotel's reputation for courteous and efficient service. In small hotels and in motels, a front-office clerk (who may be the owner) may not only rent rooms, issue keys, sort mail, and give information but also perform some bookkeeping work and act as cashier. On the other hand, large hotels may employ several front-office clerks, each with a few specific duties.

Room or desk clerks (D. O. T. 1–07.60), mostly men, have the responsible job of renting rooms and usually are the first of the front-office clerical staff to greet guests. They must try to fill any special requests for room accommodations made by guests, being careful that the rooms they assign will satisfy guests as well as yield maximum revenues for each section of the hotel. Room clerks also see that guests fill out hotel registration forms properly and may explain hotel rates and the types of services available. After registration is completed, room clerks signal bellmen to carry guests' luggage. *Key clerks* (D. O. T. 1–07.20) issue and receive room keys. *Reservation clerks* (D. O. T. 1–07.50) acknowledge guests' room reservations by mail or telephone, type out registration forms, and notify the room clerk when guests are due to arrive. To keep room assignment records current, *rack clerks* (D. O. T. 1–07.40) insert or remove forms indicating when rooms become occupied or vacant or when they are closed for repairs. They also keep housekeepers, telephone operators, or other personnel informed about changes in room occupancy. Other special clerks, such as *mail and information clerks*, are employed in some hotels. In the largest hotels, *floor supervisors* or *floor clerks* (D. O. T. 1–07.10) are assigned on each floor to handle the distribution of mail and packages and perform other incidental duties.

Front-office clerks on late evening shifts, when demands for service are less frequent, often have added duties. For example, the night room clerk may perform bookkeeping functions or assist cashiers with their clerical work.

Training and Other Qualifications

High school graduates who have some clerical aptitude and the personal characteristics necessary for dealing with the public may be hired in such beginning jobs as mail, information, or key clerk. Neatness, a courteous and friendly manner, and ease in dealing with people are important

personal traits for front-office clerical workers. Men are generally preferred as room clerks and, in some hotels, even for less important front-office work, because people in these jobs are usually considered in training for managerial posts which are held mainly by men. Typing and bookkeeping courses given in high school may be helpful, particularly for combination type jobs found in smaller hotels, or for night-shift work where additional clerical duties are often assumed. Although education beyond high school is not generally required for front-office work, hotel employers are placing increasing emphasis on college training in selecting personnel, who may later be advanced to managerial positions. Front-office clerks may improve their opportunities for promotion by taking home study courses, such as those sponsored by the American Hotel Association through the American Hotel Institute.

Regardless of their educational background, most people start out in the more routine front-office jobs. Sometimes, outstanding employees in other types of hotel work—for example, bellmen or elevator operators—may be transferred to such front-office jobs.

Inexperienced front-office workers learn mainly through on-the-job experience. However, they usually have a brief initial training period during which their duties are explained and background information is given about the hotel. They need a detailed knowledge of the location of hotel rooms and the types of services offered in order to assist guests. After new employees begin work, the assistant manager or some experienced front-office worker gives them further information when needed.

Most hotels have a promotion-from-within policy for front-office workers. Advancement depends on the individual's personal characteristics, his on-the-job performance, and, of course, on the number of openings that arise. A typical promotion ladder might be from key or rack clerk to room clerk, to assistant front-office manager, and later to front-office manager. Further opportunities exist for promotion to top managerial posts which usually require many years of hotel experience. (See statement on hotel managers and assistants.)

Employment Outlook

A limited number of openings for front-office clerks will probably arise each year during the remainder of the 1950 decade and the early 1960's. Most of the openings in this relatively small occupational group will be in beginning jobs which become vacant as a result of promotions. Some new jobs will become available in cities where new hotels will be built or existing ones expanded. In addition, a number of front-office jobs will become available in the hundreds of highway hotels and large motels that will open for business in the years ahead, as highway travel continues to increase.

Hotel employers will continue to hire women in a few front-office jobs such as those of mail and information clerk and reservation clerk—a practice which arose largely when manpower shortages developed during World War II. However, women's chances for advancement to room clerk jobs and to managerial posts will probably remain limited, since men are still preferred in these jobs. Women will find somewhat better opportunities in resort hotels.

Front-office clerks have relatively stable employment, compared with workers in many other industries. Furthermore, employment in this occupation is not likely to expand or contract as sharply with changes in general economic conditions as employment in many other hotel occupations. (See introductory section to this chapter for information on where employed, earnings and working conditions, and where to go for more information and for additional information on employment outlook.)

Housekeepers and Assistants

(D. O. T. 2–25.21, .22)

Nature of Work

Hotel housekeepers are mainly responsible for keeping guest rooms, meeting rooms, halls, and lobbies clean and attractive. They supervise the activities of maids, housemen, and other employees in their department—which is, in many instances, the largest department of the hotel. They generally hire and discharge employees, help train new ones, keep employee records, and perform

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Hotel housekeeper instructs maid in proper bedmaking.

other duties which vary with the size and type of the hotel. Of the approximately 20,000 women hotel housekeepers reported in the 1950 Census, the majority were employed in small hotels where housekeepers not only supervise the cleaning staffs but perform some of the work done by maids. On the other hand, in large hotels and smaller luxury-type hotels, the duties of the executive or head housekeeper are primarily administrative. Besides supervising a staff which may number in the hundreds, she may prepare the departmental budget; make regular reports to the manager on the condition of rooms, needed repairs, and suggested improvements; purchase or assist in purchasing supplies; take periodic inventories; and have responsibility for interior decorating work. Some executive housekeepers employed by large hotel chains may have special assignments such as reorganizing housekeeping procedures in an established hotel or setting up a housekeeping department in a newly acquired hotel.

In many hotels, executive housekeepers are assisted by floor housekeepers who directly supervise the work on one or more floors. In large hotels, there may also be an assistant executive housekeeper. The number and types of workers in the housekeeping department depend, of course, on the size and kind of hotel. In some, the housekeeper supervises not only maids and housemen (who do the heavy cleaning and move furniture) but also a variety of specialized workers such as seamstresses, draperymakers, upholsterers, furniture refinishers, painters, and carpenters.

Training and Other Qualifications

Positions as executive housekeepers in hotels are usually filled either by promoting assistant or floor housekeepers, or by hiring mature women who have performed similar work in other hotels or institutions such as hospitals. Maids and linen room attendants who have proved their ability by on-the-job performance and who have the personal characteristics necessary for supervisory jobs are considered for jobs as floor or assistant housekeepers. They must have a thorough knowledge of cleaning supplies and equipment and of the various housekeeping duties in order to organize work efficiently and to train new employees. The executive housekeeper must qualify not only in housekeeping work but also in areas such as budget preparation, purchase of equipment and supplies, and sometimes interior decorating work. Although employment as a housekeeper in a private household provides useful background, it does not generally qualify an individual to take over a job as hotel housekeeper.

No specific educational requirements exist for housekeepers but individuals may improve their opportunities for advancement by taking home study courses offered to employed hotel workers by the American Hotel Institute or courses given by some public vocational schools or private schools specializing in training hotel workers. In addition, a few colleges which give specialized training in hotel management include courses in hotel housekeeping. Probably the most helpful courses are those stressing housekeeping procedures, personnel management, interior decorating, and the use and care of different types of equipment and fabrics. Qualified women who have special educational backgrounds may be hired directly for lower supervisory positions.

Employment Outlook

Several hundred openings for housekeepers and their assistants are expected each year, continuing into the early 1960's. In 1956, the National Executive Housekeepers Association reported a strong demand for qualified women to fill positions as executive housekeepers. Most openings in the future are expected to result from the need to replace housekeepers who retire, die, or withdraw from the occupation. A relatively large number of vacancies will occur because many housekeepers are near retirement age (their median age in 1950

was more than 50 years—almost the highest for any occupation in which women were employed). Some openings for housekeepers will also arise in the few new city hotels that will be established, as well as in the growing number of large luxury motels and highway hotels that will be built to keep pace with the anticipated expansion of automobile travel. In addition, assistant housekeepers will be needed to replace those who are promoted or to fill new positions in hotels that increase their room capacity. Opportunities to gain the practical experience for houskeeping jobs will be plentiful, since many thousands of jobs will become available each year in the large occupation of maid. However, it should be noted that since only one top job as housekeeper exists in each hotel, it may take many years before an opening occurs in a particular hotel.

Opportunities for women in the older age groups to become housekeepers will continue to be good in the years ahead. Housekeepers have relatively stable employment, and employers, aware of the valuable experience acquired by their housekeepers, will generally allow them to keep on working past normal retirement age.

The best opportunities in this occupation will arise for women with administrative ability, specialized training in hotel housekeeping procedures, and a flair for interior decorating work. Housekeepers with hotel experience will also find employment opportunities in hospitals, clubs, college dormitories, and a variety of welfare institutions. (See introduction to this chapter for information on earnings and working conditions, where to go for more information, and for additional information on employment outlook.)

Hotel Managers and Assistants

(D. O. T. 0–71.13; 0–71.15; 0–97.63)

Nature of Work

Hotel managers have overall responsibility for successful hotel operations. Within the framework of policy set by owners or boards of directors, they direct and coordinate the activities of the front office, kitchen and dining room, and the various departments such as housekeeping, service, accounting, personnel, purchasing, publicity, and maintenance. They make decisions on room rates, establish credit policy, introduce improvements in operations, and assume final responsibility for settling guests' complaints. In their capacity as hosts, managers guide their staffs so as to bring about maximum satisfaction to guests at a cost which will bring the greatest profit to owners. They may also spend considerable time conferring with business and social groups and participating in community affairs, in order to increase their hotel's business.

In small hotels, the manager may perform much of the front-office clerical work in addition to his administrative duties. In the smallest hotels and in many motels, the owners—sometimes a husband-and-wife team—manage the business alone.

The general manager of a large hotel may have several assistants, each assigned an area of responsibility. An executive assistant may be employed to manage one or more departments and to take over general administrative responsibility when the manager is absent. Because food preparation and service is such an important part of the operation of most large hotels, a special manager is usually in charge of this area. (See chapter on Restaurant Occupations.) Managers of large hotels usually also employ a special assistant, known as sales manager, whose job is to promote maximum use of hotel facilities. Much of the sales manager's time is spent traveling about the country explaining to various groups the facilities his hotel can offer for meetings, banquets, and conventions.

Since large hotel chains often centralize certain activities such as purchasing supplies and equipment and planning employee-training programs, managers of these hotels may have fewer different duties than managers of large independently owned hotels. In hotel chains, managers may be assigned on a temporary basis to help organize work in a newly acquired hotel, or they may be transferred to established hotels in different States or in foreign countries.

Training and Other Qualifications

Managerial positions are usually filled by experienced men who have come up from the ranks as a result of the promotion-from-within policy followed by most hotels. Individuals who have

proved their ability, usually in front-office jobs, may be promoted to assistant manager positions and eventually to general manager.

Although hotel experience is an important requirement, employers are placing increasing emphasis on selecting managers with a college degree. Many employers believe the best educational preparation is that obtained in the few colleges in the country which offer a specialized 4-year curriculum in hotel administration, including study in the field of food management. The number of applicants seeking to enroll in 1956 in some of the large colleges of hotel management was far in excess of available facilities and, as a result, only the most promising applicants were admitted. Specialized courses in hotel work, available in a few junior colleges, and home study courses given by the American Hotel Institute are helpful.

In the colleges offering a specialized 4-year curriculum in hotel management, the courses cover a wide range of subjects including hotel administration, hotel accounting, economics, food service management and catering, and hotel engineering (plumbing and heating systems, refrigeration, and electrical equipment). In addition, students may study foreign languages and are encouraged to enroll in courses of cultural value such as history, philosophy, and literature. They must also spend 3 summers working in hotel or restaurant jobs—for example, as busboys or bellmen, room clerks, or sometimes even assistant managers. The experience and contacts with employers gained in these jobs may enable young people to obtain better hotel positions after graduation.

Young men with specialized training often start in front-office clerical jobs but, as a rule, are advanced to assistant managerial posts more rapidly than clerks with less formal training. It usually takes a number of years of experience to advance to top managerial positions. Chances for advancement may be somewhat better in hotel chains than in independent hotels, since persons may be selected to fill vacancies which arise anywhere in the chain.

Company training programs for managers are a recent development in hotels. Some large hotels have established special programs for management trainees who are college graduates or for less highly trained personnel promoted from within. Such programs consist mainly of on-the-job training assignments in which the trainee is rotated through jobs in the various hotel departments. In addition, some large hotels provide financial assistance to outstanding employees for college study.

Employment Outlook

Opportunities for employment in manager-trainee jobs in hotels are expected to be good during the late 1950's. Nevertheless, there will be keen competition for the relatively few managerial positions that become available each year in large hotels. Most of the openings for general managers will result from retirements and deaths, although some new positions will arise in the small number of new city hotels that will be built, and in the growing number of large luxury motels and highway hotels. A somewhat greater number of assistant managers will be needed to replace those who are promoted, to fill vacancies that may arise from resignations of people who leave the field, and to fill additional jobs in hotels that increase their room capacity as well as in those newly constructed.

In the long run, there will probably be a moderate increase in the number of managers employed. However, competition will continue keen for the one or more positions that may open up over a period of years in each hotel which employs managers. Young men with college degrees in hotel administration will probably have the best chances for advancement to these positions, particularly if they can handle food management or can qualify as sales managers.

Managers generally have stable employment. However, during a prolonged economic downturn, some assistant managers might be dropped.

(See introductory section to this chapter for information on where employed, earnings and working conditions, where to go for further information, and for additional information on employment outlook.)

OCCUPATIONS IN THE INDUSTRIAL CHEMICAL INDUSTRY

The Industrial Chemical Industry and Its Workers

During the past 15 years, the industrial chemical industry has become one of the Nation's major industries. The public is generally unaware of the millions of tons of industrial chemicals produced yearly because most of these chemicals never reach the consumer in the same form in which they leave the factory. This industry, however, is one of the Nation's largest material suppliers; its products are used as raw materials or as processing agents by almost every manufacturing industry. It also has an important defense role since the manufacture of armaments and munitions requires many types of industrial chemicals. The industry manufactures thousands of chemicals ranging from sulfuric acid and chlorine to rayon and synthetic rubber.

In late 1956, nearly 430,000 wage and salary workers were employed in the 1,200 plants manufacturing industrial chemicals. The industry employs men and women in a wide range of occupations. Training requirements vary from graduate college degrees for some scientists to a few days of on-the-job training for some of the less skilled plant workers.

Nature of the Industry

Industrial chemicals are produced primarily for use by other industries in further manufacturing, as opposed to other chemical products, such as pharmaceuticals and fertilizers, which go directly to the consumer without additional processing. The industry is composed of plants primarily engaged in manufacturing basic industrial inorganic and organic chemicals.

Industrial organic chemicals are derived from matter such as coal, petroleum, natural gas, and agricultural and forest products. Some products of organic chemicals, such as synthetic fibers (rayon, nylon, and orlon), synthetic rubber, and plastics materials are well known. Others, less well known to the public, include dyes and other color pigments, industrial alcohol, formaldehyde, industrial explosives, benzene, and glycerin. Among the principal users of organic chemicals are the textile, plastic products, and food processing industries which convert organic chemicals into consumer products.

Inorganic chemicals are derived from nonliving matter such as salts, sulfur, mineral ores, limestone, and water. The products of inorganic chemicals are used in almost every manufacturing industry as raw materials or as processing agents. Inorganic chemicals are basic ingredients used in the manufacture of steel, glass, paper, plastics, and thousands of other products in everyday use. Much of the output is used by the chemical industry itself in manufacturing other chemical products. Sulfuric acid is the most widely used industrial inorganic chemical and important consumers of this product are the fertilizer and petroleum industries. Nitric acid is also important as a basic raw material in manufacturing explosives, plastics, paints, and solvents. Other important inorganic chemicals are phosphoric acid, essential in the rustproofing of steel; hydrochloric acid, used for pickling steel (removing rust) prior to plating, and for manufacturing plastics and other chemicals; and soda ash, used in the manufacture of glass, medicines and drugs, and soap and other cleaning products.

The more than 1,200 industrial chemical plants are distributed throughout the country with at least 1 plant in nearly every State. (See chart 52.) A number of factors determine the location of these plants. To minimize transportation costs, establishments making the heavy inorganic chemicals are often built near the source of raw materials. For example, plants producing salts and alkalies are located near great underground deposits of salt, like those in Louisiana or in some parts of the Northeast; and plants producing chemicals made from petroleum and natural gas are located near the oilfields of Texas, California, and Louisiana. Other types of chemical plants are constructed near the users of their products. The availablity of cheap and abundant power and water supplies are also factors in deciding plant location. In addition, because of the large amount of space required for plants and the problem of

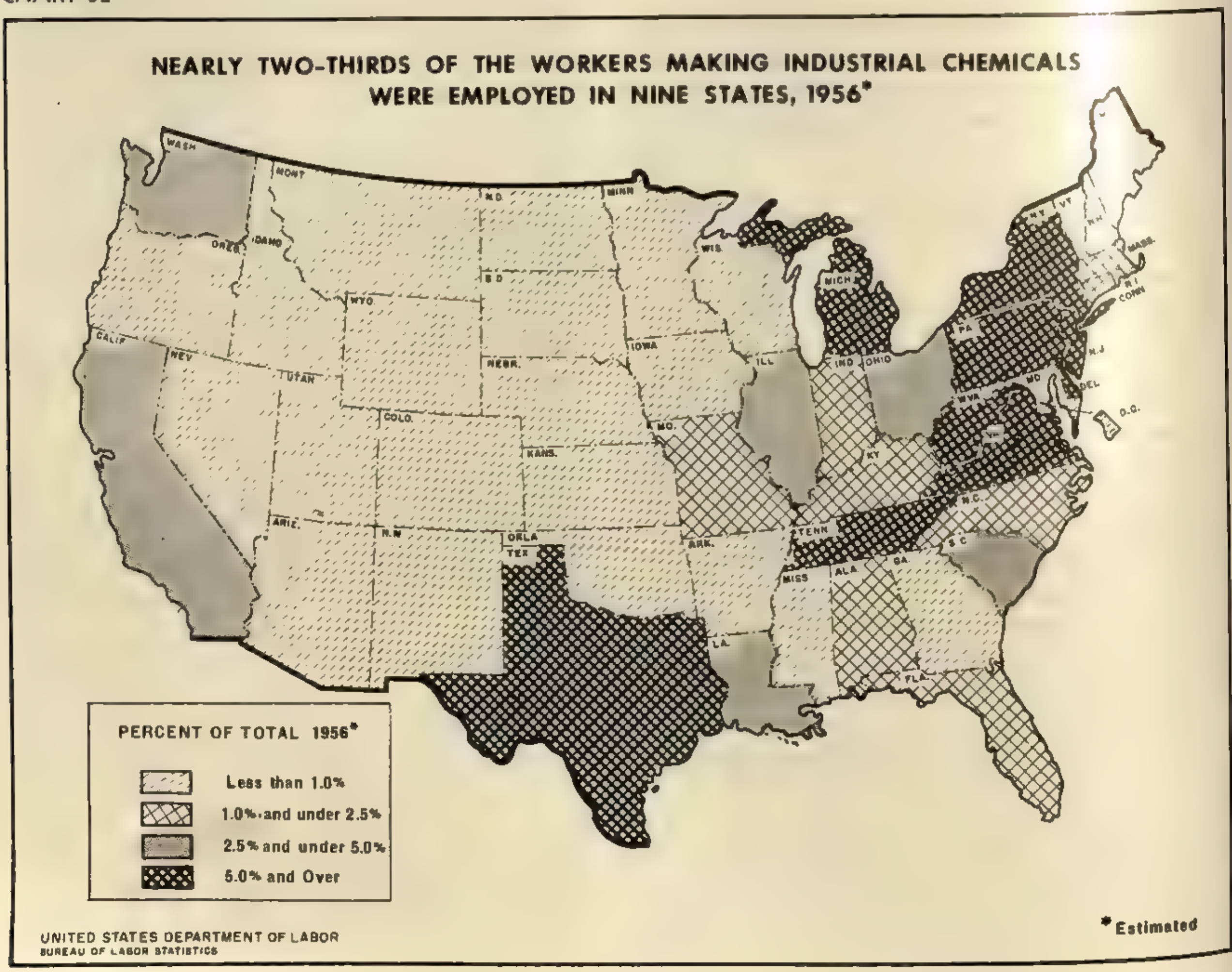
disposal of waste products and gases, many plants are located in rural areas or on the outskirts of industrial centers.

Almost half of the workers employed in the industrial chemical industry in 1956 were working in the Middle Atlantic and the South Atlantic States. The other large concentration of employment was in the East North Central and East South Central States. The States with the largest numbers of industrial chemical workers were Tennessee, New Jersey, Virginia, and Texas, accounting for almost one-third of industrial chemical workers. Other States with large numbers of industrial chemical workers were Pennsylvania, New York, West Virginia, Michigan, and Delaware. (See chart 52.)

Methods of manufacturing the thousands of industrial chemicals are as varied as the products made. A description of the processes in manufacturing any one chemical would not be representative of the industry as a whole since different processes are used to make different chemicals. A few generalizations, however, can be made to illustrate certain basic processes that may be considered typical, enabling the reader to understand the types of jobs found in this industry.

Industrial chemicals are made by changing raw materials through both chemical and physical processes. Through chemical changes, new compounds are formed from these raw materials by combining various chemicals, by breaking down chemical compounds, or by building them up to more complex forms. The chemical processes used to effect these changes include oxidation, electrolysis, neutralization, cracking, polymerization, and fermentation. Some of the physical processes are grinding, mixing, evaporation, drying, filtration, crystallization, absorption, and distillation. Several types of equipment or methods can be used to perform each operation. For example, solids

CHART 52



may be separated from liquids by filtration, by centrifugal equipment, or by settling.

Most chemical plants, especially those making inorganic chemicals such as acids or alkalies, have vast network of pipes. These pipes are necessary for intraplant transfer of chemicals which are mainly in liquid form during processing. Generally, large volume production methods are used, taking the form of continuous flow-type production in which raw materials are fed into the pipes and the finished products are withdrawn with minimum handling of materials by workers.

Many chemicals are manufactured in large reactors or kettles in which raw materials are combined or separated. Often, chemicals must pass through several reaction operations to produce the desired end product. Chemicals flow from one reactor to another through the network of pipes. Throughout both the processing operations and the transferring of chemicals between operations, automatic control devices usually regulate the flow of materials, the combination of different chemicals, and the temperature, pressure, and time in each operation. Automatic control devices make it possible to combine several different operations into a single continuous operation, with a minimum of manual handling.

Industrial Chemical Occupations

Workers with many different levels of skill and education are employed in the manufacture of industrial chemicals. By far the largest proportion (about 70 percent) of employees work in plant occupations. The operations of the industry make it dependent upon a large number of technical workers, including chemists; chemical, mechanical and electrical engineers; laboratory assistants; and draftsmen. Many different types of administrative and related personnel, such as purchasing agents, accountants, personnel officials, and salesmen are also employed as well as many clerks, stenographers, bookkeepers, typists, and other office workers.

In late 1956, about 55,000 women worked in industrial chemical plants, mainly in such office jobs as bookkeepers, clerks, stenographers, and office machine operators. In the plants, they usually work as laboratory assistants, packers, or as custodial workers. In some plants, they are employed as operators. Some women also work in the research laboratories as analytical and research chemists.

Plant Occupations

Chemical plant workers can generally be divided into three major occupational groups: the production workers who operate the chemical-processing equipment; the maintenance workers who maintain, install, and repair the machinery, pipes, and equipment; and other plant workers, such as stock clerks, material handlers, truckdrivers, and others not included in the first two groups.

Process equipment operators and their helpers are the largest occupational group in the industrial chemical industry. Many of these operators are skilled workers. *Chemical operators* (D. O. T. 4–52.770 and 6–52.770) operate one type of equipment or direct a chemical process utilizing several types of chemical equipment to produce final or intermediate chemical products in accordance with prepared specifications. Their duties, however, are relatively similar regardless of the type of equipment they operate. Some skilled chemical operators determine the proper proportion of materials to be processed according to formulas or specifications prepared by a chemist. They set and regulate the controls for temperature, pressure, or flow of materials. They also keep a running record of the quality of the operation and report any sign of breakdown or variation from the specifications. They may use measuring and testing instruments or, occasionally, they may send samples of the material to the testing laboratory. Chemical operators are responsible for the quality and quantity of the product. They may be assisted by other chemical operators of less skill as well as by helpers.

Some of the chemical operators are designated according to the type of equipment operated. For example, *stillmen* (D. O. T. 4–51.635 and 6–51.630) operate the distillation equipment that separates volatile mixtures into component parts. *Autoclave operators* (D. O. T. 4–52.711) operate high-pressure vessels, called autoclaves, in which the reaction involves chemical changes within highly critical pressure and temperature limits. *Evaporator men* (D. O. T. 4–51.755) operate equipment that concentrates chemical solutions by removing part of the water content. Since different processes are used to make the many types of chemicals, the kinds of chemical operators vary from plant to plant. For instance, the autoclave operator, an important chemical operator in plants making al-

kalies and chlorines, may not be employed in a plant making plastic materials.

In addition to the chemical equipment operators, there are other process workers who operate the physical process equipment that prepares the raw material for further processing. They tend the various machines which produce such physical changes as the breaking down and refining of chemicals. For example, *grinders* (D. O. T. 6–52.751) operate machines which reduce the size of solid particles and screen the resultant powder to meet laboratory specifications. *Filterers* (D. O. T. 6–51.855 and .870) operate one or more units of filtering equipment used in separating suspended solids from liquids. *Driers* (D. O. T. 6–51.820) operate one or more units of equipment used in separating water or other volatile liquid components from solids. Volatile components are removed by heating the solids with circulating hot acid or steam and by maintaining a vacuum over the solids. *Millers* (D. O. T. 6–52.751) tend one or more units of equipment used to crush, grind, or pulverize materials to specifications. *Mixers* (D. O. T. 6–51.926) operate one or more machines in which component parts (liquids or solids) are blended or mixed in controlled amounts.

Because industrial chemical manufacturing requires a large amount of complicated equipment and because high temperatures and pressures greatly increase the wear on this equipment, the

Autoclave operators tend high pressure vessels in which the reactions involve chemical changes within highly critical pressure and temperature limits.

industry employs a large number of maintenance workers. Important maintenance occupations include *pipefitters* who lay out, install, and repair pipes and pipefittings; *carpenters* who construct and maintain the woodwork and equipment such as doors, partitions, and floors; *maintenance machinists* who produce replacement parts and new parts for the mechanical equipment in an establishment; and *electricians* who maintain wiring, motors, switches, and other electrical equipment in good operating condition, and make repairs when equipment breaks down. In addition, this industry employs many highly skilled *instrument repairmen* (D. O. T. 5–83.971) who install and repair the vital electric and electronic instruments which regulate, record, and control the flow of chemicals in many manufacturing processes. The job of instrument repairman is a relatively new specialization in the chemical industry and has become increasingly important because of the growing use of automatic controls in chemical processing. In some instances, maintenance jobs may be combined into a single job involving general maintenance mechanic duties. (A detailed discussion of the duties, training, and employment opportunities in maintenance jobs appears elsewhere in this Handbook. See index for page numbers.)

Stillman observing and recording instrument readings showing temperature, pressure, and chemical changes.

Other plant workers, who do not operate or maintain equipment, perform a variety of tasks in industrial chemical plants. Some workers

Instrument repairmen are an important and growing occupation in industrial chemical plants.

drive trucks and tractors, making deliveries to various parts of the plant; some load and unload materials on trucks, trains, or ships; and other workers keep inventory records of stock and tools. The industry also employs custodial workers such as guards, watchmen, and janitors whose jobs are similar to those in other industries.

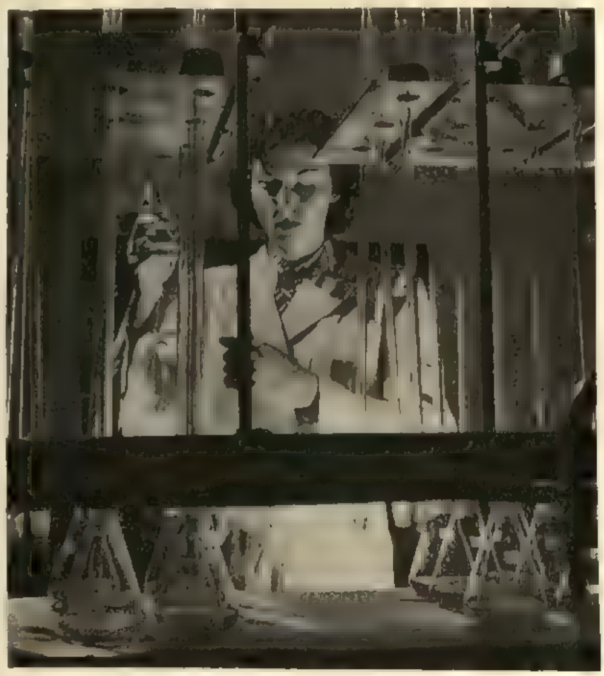
Technical Occupations

Because of the highly technical nature of its operations, the industrial chemical industry employs many persons with chemical, engineering, or other scientific backgrounds. A large proportion of these personnel are employed in the industry's research activities to develop new chemical products and new methods of production. According to a 1954 Bureau of Labor Statistics survey of research and development manpower in American industry prepared for the National Science Foundation, 13.7 percent of the Nation's research engineers and scientists were employed by chemical firms. More than 50 percent of the chemical industry's research engineers and scientists were employed by industrial chemical firms.

This industry is one of the principal employers of chemists and chemical engineers. *Chemists* (D. O. T. 0–07.21) are engaged in a number of different functions. Many work in research laboratories. A large number are employed in the production departments where they control the quality of the product being manufactured by supervising the testing of materials during processing. Some chemists work as supervisors of plant workers. Others work as technical salesmen, technical writers, or in administrative positions requiring technical knowledge.

Chemical engineers (D. O. T. 0–15.01) are concerned with the application of chemical engineering science to the design, construction, operation, control, and improvement of chemical processing equipment. They convert processes developed in a laboratory into large-scale production methods using the most economical manufacturing techniques. Some chemical engineers are employed in production jobs as well as in jobs which are customarily held by chemists.

Several other types of engineers are also employed in industrial chemical firms. *Mechanical engineers* (D. O. T. 0–19.01) design and lay out plant equipment, and plan the central distributing system for heat, gas, water, or steam. *Electrical engineers* (D. O. T. 0–17.01) are concerned with instrumentation and control, and power genera-



Laboratory technician testing samples.

tion and distribution. They also design and develop all types of electrical and electronic machinery and equipment.

In addition to the large number of professional and technical personnel, the industry employs many technical assistants such as *laboratory technicians*, *draftsmen*, *engineering aids*, *chemical analysts*, and *production supervisors*. *Laboratory technicians* assist chemists and engineers in research and development work and in production control. They may perform simple routine tests or do highly technical, analytical work, depending on their training and experience. Much of the work of the laboratory technicians consists of conducting tests and recording the results—often in the form of simple reports, charts, or graphs for interpretation by the chemists and chemical engineers.

Draftsmen prepare detailed drawings from sketches or specifications furnished by the engineers. Some draftsmen do only rough copying or routine tracing work; others, at higher levels of skill, may also make calculations concerning the strength, quality, and cost of materials. (More detailed descriptions of the duties, training, qualifications, and employment outlook of chemists, engineers, and other scientific and technical occupations appear elsewhere in this Handbook. See index for page numbers.)

Administrative, Clerical, and Related Occupations.

The industrial chemical industry employs a wide variety of administrative, clerical, and other "white collar" personnel. Many of the higher level administrative and management positions are filled by technically trained men, many of whom are chemists or chemical engineers. At the top of the administrative group are the executives who make policy decisions concerning matters of finance, types of products to manufacture, and location of plants. To make such decisions, the executives require the help of a large body of specialized personnel. Some of the specialized workers in the field of administration are *accountants*, *purchasing agents*, *sales representatives*, *lawyers*, and personnel employed in such activities as *industrial relations*, *public relations*, *transportation*, *advertising*, and *market research*.

Other "white collar" workers are required to assist these specialized administrative workers. For example, clerical employees keep personnel, payroll, raw materials, sales, shipments, and plant maintenance records.

Training, Other Qualifications, and Advancement

The industrial chemical industry generally hires inexperienced workers for processing jobs and trains them on the job. Companies in the industry usually prefer to hire young workers with some high school education.

In many plants, a new worker is assigned to a labor pool where he does such jobs as filling drums, moving materials, and helping skilled chemical operators. After working in the labor pool for several months, he may be transferred to a processing or maintenance department when a vacancy occurs. As he gains experience and "know-how," he moves to the more skilled jobs in his department. He may advance from a job as a laborer to that of chemical operator helper and eventually may become a skilled chemical operator. Skilled process workers are rarely recruited from other plants.

Although maintenance jobs are sometimes filled by hiring experienced men, they are generally filled by men trained in the plant. Many industrial chemical companies have training programs to meet the needs of their maintenance shops. These programs may last several months or a few years and include mainly on-the-job training and some classroom instruction related to the trainee's particular work. Many companies encourage skilled maintenance workers, as well as trainees, to take courses related to their jobs in local vocational schools and technical institutes, or to enroll in correspondence courses. Upon the successful completion of these courses, some companies reimburse the workers for part or all of the tuition.

A bachelor of science or a bachelor of engineering degree from a recognized college is usually the minimum educational requirement for scientists and engineers. For research jobs, persons with advanced degrees are preferred. Some companies have formal training programs for young college graduates with engineering or scientific backgrounds. These men work for brief periods in the various plant-operating divisions to gain a broad knowledge of chemical manufacturing operations before being assigned to a particular department. Other firms immediately assign junior chemists or engineers to a specific research, operating, or maintenance unit.

Not all persons who work as technicians are specifically trained for their occupations. A person may become a technician by studying at a technical institute or vocational school. Many technical institutes offer 2-year programs which will qualify a person as a laboratory assistant. Engineering or chemistry dropouts; graduates and dropouts of liberal arts colleges, especially those with chemistry, mathematics, or other scientific training; and other persons who have received post-high school education often become technicians. Workers may also qualify as technicians through experience only. Some industrial chemical firms have programs to train draftsmen and laboratory technicians. Laboratory assistants begin their work in routine jobs and advance to positions of greater responsibility after they have acquired additional experience and demonstrated their ability to work without close supervision. Inexperienced draftsmen usually begin as copyists or tracers. With additional experience and training, workers may advance up the job ladder to more skilled and responsible drafting positions.

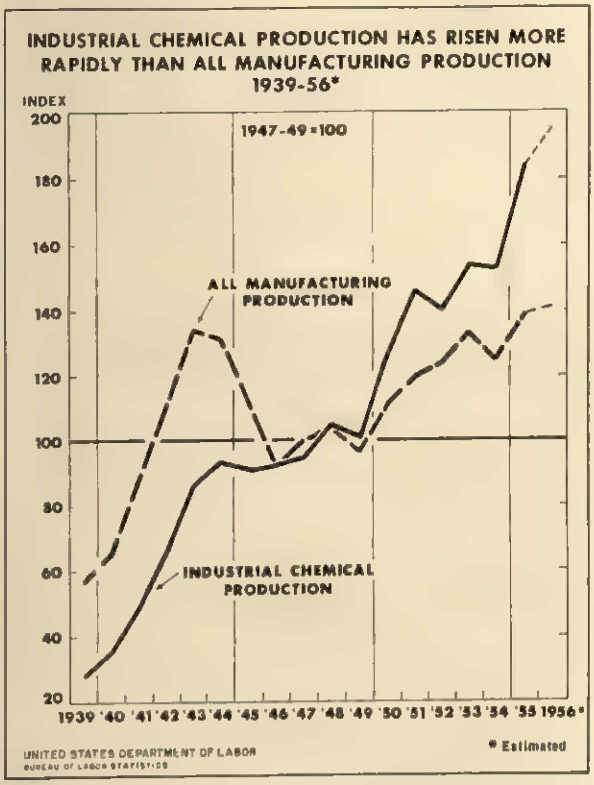
Administrative positions are frequently filled by men and women who have college degrees in business administration, marketing, accounting, industrial relations, or other specialized fields. Some companies have advanced training programs in which they give their new employees additional training in their specialties. Most industrial chemical firms employ persons who have had commercial courses in high school or business schools for positions as clerks, bookkeepers, stenographers, and typists. Although the qualifications for and the duties of administrative, sales, clerical, and related occupations are similar in this industry to those in other industries, a knowledge of chemistry is sometimes helpful. This is especially true of sales jobs where it is often necessary to give customers technical assistance.

Employment Outlook

The industrial chemical industry is expected to provide thousands of job opportunities for new workers during the late 1950's and the 1960's. Many of these openings will result from the expected expansion of the industry. (The industry's employment is expected to increase at a somewhat faster rate than the Nation's total labor force.) The need to replace those workers who die, retire, or transfer to other fields of work will also provide many job openings for new workers.

The industrial chemical industry is one of the Nation's most rapidly growing manufacturing industries. (See chart 53.) It is a major supplier

CHART 53



of raw materials to almost every other industry and, therefore, its future growth is directly related to the general expansion of the economy.

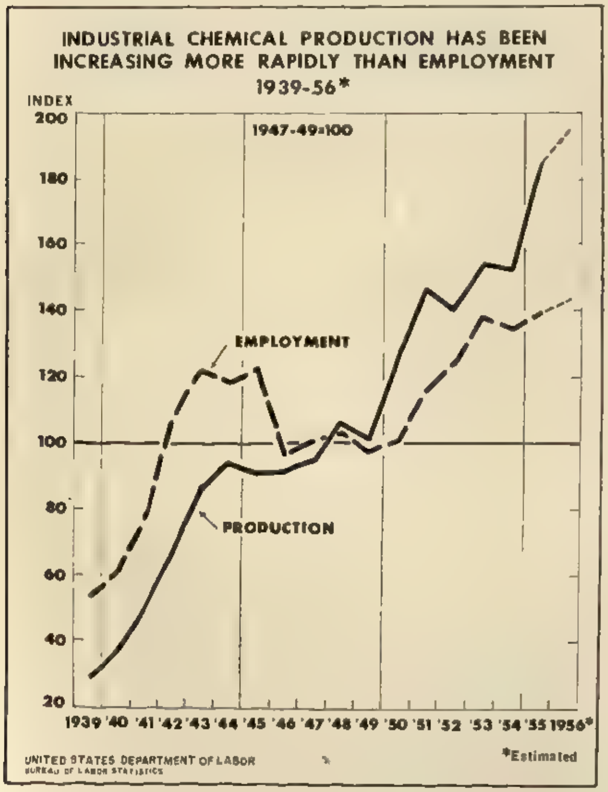
Although the industrial chemical industry has made amazing progress in the past, it has vast potential for further development from its research activities. This dynamic industry has far outstripped most other major industrial groups in rate of growth and in the development of new products. Some of these products have created completely new markets. Others, like plastics and synthetic fibers, have competed successfully in markets previously dominated by wood, natural textile fibers, and metals, and are expected to continue to make inroads in these markets. A plentiful supply of the raw materials used in chemical manufacturing is also favorable to the industry's future growth. The development of atomic energy is another factor of potential growth for this industry. New chemicals will be required for the manufacture of radioactive materials. Further-

more, radioactive elements hold promise for new products to be made by chemical processes not yet developed.

The new products and new methods of production, which are typical of the industry, are the results of its emphasis upon research and development. The industry's expenditures for research and development are among the highest in American industry.

Between 1940 and 1956, there was a fivefold increase in the output of industrial chemicals, and employment more than doubled. (See charts 53 and 54.) Continued expansion in production is anticipated in the late 1950's and the 1960's. However, employment is expected to increase at a much slower rate than production. This has been the industry's experience for many years. For example, 1955 output was 90 percent above that of 1947, whereas employment increased only 40 percent. One of the important factors in the increasing output per worker has been the widespread use of automatic processing and control equipment which enables the industry to manufacture its products with a relatively small amount of labor. Despite the technological progress which is anticipated in this industry in the future, the expansion of output is expected to result in increased employment above the 1956 level.

CHART 54



Although all major occupational groups are expected to grow, some will increase at a faster rate than others. The number of technical and administrative workers is expected to increase at a faster rate than the number of plant workers. This will be a continuation of recent trends in this industry. In 1948, nonproduction workers made up about 22.5 percent of the industry's total employment, compared with more than 30 percent in 1955. The continued emphasis on research and development and the greater complexity of products and processes are expected to result in an increasing need for chemists, chemical engineers, and technicians.

The largest relative increase in employment of plant workers will be in maintenance and repair occupations such as instrument repairmen, pipefitters, electricians, and maintenance mechanics because of the increasing use of instrumentation and automatic equipment in processing operations. Processing equipment operators will continue to be the largest occupational group in the industry although employment of these workers is not expected to increase as much as the employment of maintenance and repair workers.

Employment opportunities will also result from the need to fill vacancies created by death, retirement, or transfer of workers to jobs in other fields. Deaths and retirements alone will provide on the average about 7,000 to 9,000 openings for new workers each year during the 1956–66 decade.

Earnings and Working Conditions

Earnings of production workers in the industrial chemical industry are among the highest for factory workers in American industry. In December 1956, workers employed in inorganic chemical plants averaged $2.37 an hour and $98.12 a week; and those working in organic chemical plants averaged $2.30 an hour and $94.99 a week. This compares with the average hourly earnings of $2.05 and average weekly earnings of $84.05 for all manufacturing industries in the same month.

The accompanying table, based upon a wage study made by the Bureau of Labor Statistics, indicates the average straight-time hourly earnings of workers in selected occupations in the industrial chemical industry, by region, in August 1955. It

Earnings in selected occupations, industrial chemical industry, by region, August 1955

Occupation	Average straight-time hourly earnings, August 1955									
	United States	New England	Middle Atlantic	Border States	Southeast	Great Lakes	Middle West	Southwest	Mountain	Pacific
Processing occupations:										
Chemical operators, class A	$2.29	$1.99	$2.27	$2.34	$1.98	$2.19	$2.15	$2.51	--------	$2.29
Chemical operators, class B	2.14	1.82	2.00	2.21	1.87	2.05	1.94	2.43	$2.43	2.13
Chemical operators' helpers	1.90	1.73	1.82	1.91	1.63	1.92	1.88	2.11	2.08	2.00
Compressors	2.31	--------	2.15	2.33	--------	2.30	2.01	2.38	--------	2.27
Millers, class A	1.95	--------	2.06	1.63	--------	2.05	--------	2.04	--------	2.07
Millers, class B	1.82	--------	1.75	1.57	1.73	1.90	1.69	--------	2.42	--------
Mixers, class A	1.94	--------	1.87	1.71	1.60	2.06	--------	--------	--------	--------
Mixers, class B	1.80	--------	1.81	1.60	1.34	2.02	1.67	--------	--------	2.15
Pumpmen	2.12	--------	2.01	1.93	1.94	2.10	1.97	2.31	--------	2.08
Maintenance occupations:										
Carpenters, maintenance	2.36	2.09	2.35	2.22	2.16	2.34	2.31	2.55	2.71	2.38
Electricians, maintenance	2.41	2.17	2.36	2.31	2.21	2.36	2.31	2.59	2.52	2.43
Lead burners	2.58	--------	2.63	2.56	--------	2.49	--------	2.55	--------	2.67
Machinists, maintenance	2.41	2.22	2.32	2.29	2.10	2.37	2.29	2.58	2.64	2.43
Pipefitters, maintenance	2.41	2.18	2.37	2.35	2.15	2.36	--------	2.57	2.69	2.44
Helpers, maintenance	1.99	1.88	1.87	1.99	1.66	2.00	1.87	2.07	2.31	2.08
Material handling occupations:										
Carton fillers	1.79	--------	1.88	--------	--------	--------	--------	--------	--------	2.01
Cylinder fillers	2.01	--------	2.11	--------	--------	2.00	--------	--------	--------	2.12
Drum fillers	1.92	--------	1.89	2.02	1.35	1.98	1.75	2.07	--------	2.10
Filling machine tenders	1.89	--------	1.89	1.72	1.41	2.00	1.88	1.73	--------	1.96
Laborers, material handling	1.67	1.69	1.68	1.55	1.41	1.85	1.70	1.65	1.87	1.89
Stock clerks	2.07	1.84	1.96	2.03	1.75	2.07	2.01	2.27	2.14	1.98
Truckdrivers	2.03	1.88	2.14	2.00	1.60	2.05	1.80	2.06	2.07	2.17
Truckers, power (forklift)	1.86	1.83	1.86	1.70	1.28	1.99	1.94	1.98	--------	2.08
Truckers, power (other than forklift)	1.96	--------	1.99	1.91	--------	2.04	--------	1.70	--------	2.10
Custodial occupations:										
Guards	2.02	1.83	1.90	2.04	1.86	2.07	--------	2.15	2.08	1.84
Janitors	1.74	1.69	1.68	1.70	1.47	1.86	1.71	1.72	1.85	1.89
Watchmen	1.71	--------	1.65	1.65	1.18	1.95	1.45	1.76	--------	1.67
Laboratory assistants:										
Laboratory assistants—men	2.10	1.92	2.13	2.16	1.71	2.00	2.03	2.23	2.15	2.15
Laboratory assistants—women	1.87	--------	1.95	1.80	--------	1.65	--------	2.02	--------	--------

should be noted that between August 1955 and August 1956, the average hourly earnings of production workers in this industry increased by 13 cents.

Wages were generally higher in the Middle Atlantic, Great Lakes, and Southwest regions; and lower in New England and the Southeast. Skilled maintenance workers and class A chemical operators were the highest paid factory workers.

Comprehensive earnings data for engineers and scientists in this industry are not available. (A detailed discussion of earnings in individual professional and technical occupations are included elsewhere in this Handbook in the statements on these occupations. See index for page numbers.) However, a 1956 survey conducted by the American Chemical Society indicated that the entry salaries for engineering and professional personnel were among the highest in American industry. The survey showed that in this industry the average (median) starting salary for chemists with a bachelor's degree was $410 a month, and $425 a month for chemical engineers with a bachelor's degree. Chemists and chemical engineers with graduate degrees receive higher starting salaries. For example, the 1956 survey showed that chemists with a doctor's degree received a starting salary of $615 a month.

Paid vacations are universal in this industry and are generally based on length of service. Workers commonly receive 1 week after 1 year of employment; 2 weeks after 5 years; and 3 weeks after 15 years.

A majority of the workers are covered by insurance plans. These plans include life, sickness, accident, hospitalization, and surgical insurance. Practically all the plants have pension plans.

Many of the workers are employed in large continuous process plants that operate around the clock, 7 days a week, and 3 shifts a day. Owing to the widespread industry practice of rotating shifts, workers can expect to work the odd shifts at one time or another. Virtually all plants pay a differential for shift work, most commonly 6 to 8 cents an hour for the second shift, and 10 to 12 cents an hour for the third or night shift. Relatively few maintenance workers are employed on the odd shifts. Work in the industry is subject to few seasonal variations and all the regular workers have year-round jobs.

Working conditions vary with the type of job, the kind of equipment, and the size, condition, and age of the plant. In some plants, workers are exposed to dust, disagreeable odors, and extreme temperatures. Chemical companies, however, have made intensive efforts in recent years to reduce the discomforts arising from these conditions by the

introduction of improved ventilating systems. Safety measures such as protective clothing, placard warnings in danger areas, the placement of showers and eye baths near dangerous work stations, and first-aid stations have also reduced hazards.

As a result of such measures, the injury-frequency rate for the industrial chemical industry is much lower than the average rate for all manufacturing industries. In 1955, the average number of disabling injuries was 5.3 for each million man-hours worked in industrial inorganic chemical plants, and ranged from 1.6 to 4.5 in the different segments of the industrial organic chemical industry. This compares with an average of 12.1 for all manufacturing industries.

With the exception of the work performed by laborers and material handlers, most industrial chemical jobs do not require heavy physical labor. Much of the plant work involves tending, inspecting, or maintaining machinery and equipment since most of the processes are automatic or semi-automatic. Some workers climb stairs and ladders to considerable heights and have to open and close heavy valves in the course of their duties. Other jobs are performed out of doors in all kinds of weather.

Most of the production workers in the industrial chemical industry are members of labor unions. The leading unions are: the International Chemical Workers Union; Oil, Chemical and Atomic Workers International Union; and District 50, United Mine Workers of America (Ind.).

Where To Go for More Information

Further information concerning jobs, processes, and working conditions in the industrial chemical industry can be obtained from the following sources:

Manufacturing Chemists' Association, Inc., 1625 Eye St. NW., Washington 5, D. C.

International Chemical Workers Union, I. C. W. U. Bldg., 1659 West Market St., Akron 13, Ohio.

INSURANCE OCCUPATIONS

The Insurance Business and Its Workers

Insurance is a vast and growing business which ranks with such great industries as automobiles, iron and steel, and telephone and telegraph in the number of people employed. It offers employment opportunities to both young inexperienced workers and mature people. In 1955, nearly 800,000 persons were employed to carry on the multibillion dollar insurance business.

Most adults own one or more insurance policies to protect them against loss from some of the many hazards to life and property. People can insure almost anything they consider valuable—from a prized personal possession, such as a rare book or a pet, to something on which earnings depend—for example, a ballet dancer's legs or a pianist's hands. However, the policies most commonly sold are those which insure life, dwellings, business plants, machinery, crops, automobiles, and other valuable possessions. People also pay into insurance plans to provide funds for retirement, sickness or disability, and the education of children. Insurance enables families and businessmen to conduct their affairs with the assurance that money will be available in emergencies, when it is most needed.

In our economy, the insurance business is important not only for the financial protection it offers, but also for its large-scale investment activity. The billions of dollars invested every year by insurance companies provide corporations with money to build new plants and to purchase equipment and machinery. Thousands of new homes for families have been financed through mortgages held by life insurance companies. Such huge investments stimulate economic activity and contribute to the Nation's growth, while at the same time, they provide interest income which is used to help meet the insurance costs and for other business purposes.

Nature of Business

Insurance is divided into two major branches—life and property and casualty—which employ about equal numbers of workers. Life insurance—defined as including pensions, annuities, and disability insurance as well as life insurance—provides funds for the personal needs of individuals and families in case of death, retirement, or disability of the insured. Life insurance companies also sell accident and health insurance. Many kinds of special life insurance policies exist, such as those which give extra financial protection to families with young children or those which insure owners of large estates where inheritance and tax laws complicate insurance matters. Property and casualty insurance companies handle insurance commonly grouped as casualty, fire, marine, and surety. These companies provide policies that protect owners against loss or damage to property from perils such as fire, hail, and windstorm. They also sell liability insurance, including workmen's compensation and automobile insurance. In addition, casualty companies sell fidelity bonds which protect employers against theft by employees who handle large sums of money. Under recently enacted legislation, property and casualty companies may sell most kinds of insurance, except life insurance, in a single policy. Casualty companies as well as life companies often sell accident and health insurance policies. These policies, as well as pension and life insurance policies, may be sold on a group basis, covering the few employees of a small firm or the many thousands in a large corporation.

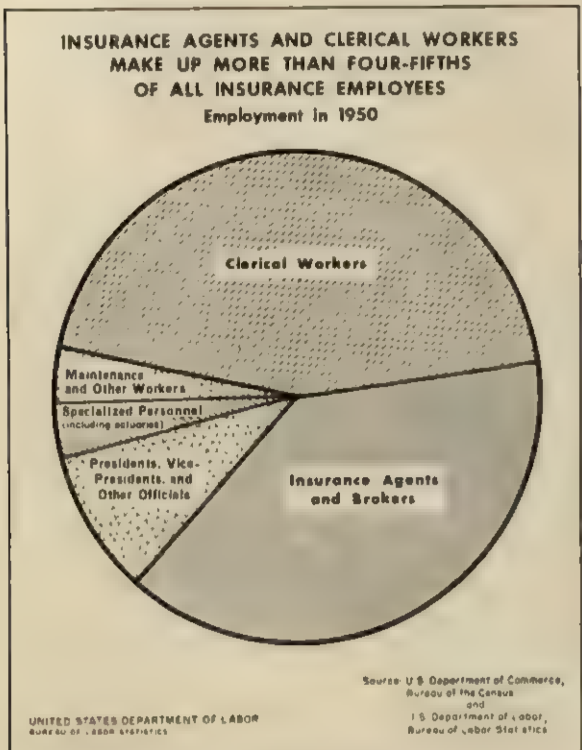
More than 1,000 life insurance companies and approximately 3,500 property and casualty insurance companies were in operation in 1955. Most of these companies, commonly referred to as home offices, have agency outlets throughout the country. There are probably at least 50,000 insurance agencies, either maintained by insurance companies as branch offices or operated by agents in business for themselves.

Insurance Workers

The work in company home offices is carried on by thousands of clerical workers and a relatively small number of professional employees under the direction of insurance executives. Clerical work-

ers, located mainly in home offices, are the largest group of insurance workers, representing about 45 percent of the total number in 1950. (See chart 55.) About 10 percent of all insurance employees

CHART 55



are executives—company presidents, vice presidents, department heads, or other officials. About 4 percent are professional specialists, including accountants, lawyers, doctors, nurses, engineers, and a few workers in occupations unique to the insurance field—chiefly actuaries, home-office underwriters, and claim adjusters. Actuaries, who usually have college degrees in mathematics, determine what classes of risks should be accepted and what rates should be charged in order to keep the insurance company financially sound. Home-office underwriters make responsible decisions on whether to accept or reject insurance risks and select the appropriate premium rates. Although the life insurance agent may also be called a life underwriter, selling and home-office underwriting are separate functions. Claims adjusters determine whether claims relating to injury, damage, or loss are justified and see that proper payment is made under the terms of insurance policies. Home-office underwriters and claim adjusters receive considerable on-the-job training, even though they may be college graduates. A number of companies select promising young people who have gained experience in other departments and train them for underwriting and claims work. People selected from within the company usually have acquired some knowledge of policy provisions or insurance procedures required in their new jobs.

In addition to the employees in the home offices of insurance companies, large numbers of agents work at agency offices. Agents make up nearly 40 percent of all insurance employees and are exceeded in number only by the clerical workers. Employment opportunities for clerical workers, as well as for the two main types of agents—those selling life insurance and those selling property and casualty insurance—are discussed in statements on pages 504 and 507. Employment opportunities for actuaries—the small group of professional workers responsible, in large part, for the soundness of the insurance business—are discussed in a separate statement on p. 509.

Where Employed

Insurance companies and agencies do business in every section of the country. However, insurance workers are concentrated in the more industrialized and heavily populated States. The 10 States with the most population, with one exception, had the greatest number of insurance workers in 1950. New York led all other States, with approximately 15 percent of the country's insurance employment, followed by California with nearly 9 percent. Insurance workers are employed mainly in large metropolitan areas; for example, more than 80 percent of California's insurance workers were in the San Francisco–Oakland and Los Angeles metropolitan areas. The location of company home offices also affects the type of employment available, since these central offices employ many more clerical workers, administrative officers, and professional workers than do insurance agencies. Connecticut, a long-established center for insurance home offices, has as many insurance workers as Michigan, though the latter State has three times the population.

For many years, most large life insurance companies (those with over $1 billion of insurance in force) were located in the Northeastern States. However, in the past 15 years, the number of large

companies has tripled and become more widespread geographically.

A few companies doing a nationwide business each employ more than 10,000 workers in their home offices and are served by an even greater number of agents located throughout the country. Some small companies have no agency outlets and cover a limited rural area with only a few employees. The vast majority of agency offices have fewer than 10 employees; only a small proportion have 100 or more.

Employment Outlook

Many thousands of job openings in insurance companies and agencies are expected each year, continuing into the 1960's. Employment, which increased nearly 45 percent from 1947 to 1955, will probably rise at a more moderate rate over the next 8 or 10 years. Most openings will be for clerical workers and insurance agents. In addition to the new jobs, many openings will result from turnover, which is high for insurance agents during their first few years of employment, as well as for the large number of young women clerical workers. Although most job openings will naturally be in these largest occupational groups, qualified young people will also be in demand as trainees for positions in underwriting, claim adjusting, and actuarial work.

Among the basic factors which point to expansion of the life insurance business are the rapid growth of population, which multiplies personal insurance needs, and favorable economic conditions which make it possible for more people to buy insurance policies. It is estimated by industry leaders that life insurance sales may reach an annual rate between $75 and $90 billion by 1965, or from one and one-half times to nearly double 1955 sales. Additional life insurance sales are anticipated as advances in medical science make insurance available to people formerly turned down as poor risks. Continued expansion is expected of the fast growing group pension, health, and welfare plans for employees. The need to finance longer periods of retirement also may lead more people to buy retirement annuities. Catastrophe medical plans, which take care of expenses during major illnesses, covered approximately a million people in 1954 and will probably increase in importance. "Key man" insurance, offered as protection to businesses against loss of income upon the death of important officials or key technical men, is being sold on a larger scale. Policies for educational purposes may become more widespread as a higher proportion of parents plan to send their children to college and as the trend toward more years of expensive educational preparation for professional work continues. Government insurance programs will probably continue to stimulate private insurance sales by making people more "insurance conscious." Millions of workers with some insurance needs covered under the social security system and World War II veterans' GI insurance have purchased additional insurance from private companies. In many cases, these contacts led to insurance sales for other family members.

Growth of the property and casualty insurance field is also expected with the continuation of favorable economic conditions. Insurance needs of businessmen will probably continue to rise owing to expanding markets for products which will lead to the building of additional plant facilities and the installation of new and more expensive machinery. Automobile insurance, the largest line written in the casualty field, will continue to grow with car ownership and the extension of laws requiring insurance. More purchases of new homes by families will also expand property and casualty insurance sales. Additional sales may result from coverage relating to unusual hazards—for example, policies which insure persons and property against radiation hazards from industry-operated atomic reactors. More policies will be sold as coverage under workmen's compensation laws is continued and broadened under State legislation.

Although the outlook is favorable for expanded insurance employment, it is probable that the rate of increase will be lower than that indicated by anticipated insurance sales. A major factor that must be considered is the more widespread use in the future of new office machines, especially electronic computers. This factor—commonly referred to as automation—will affect employment in some occupations more than others. The effect of the extensive use of electronic equipment is discussed further in the statement on insurance clerks and office-machine operators later in this report.

Insurance workers have more assurance of regular employment than workers in many other in-

dustries during periods of economic recession. People attempt to retain as much basic financial protection as possible, even when incomes decline. For most businessmen, property insurance of all kinds is a necessity. Failures of life insurance companies during the depression of the 1930's were confined mostly to small companies with only a fraction of total employment in the business.

Insurance Clerks and Office-Machine Operators

Nature of Work

More than 330,000 clerical workers are employed in the insurance business to handle the mountains of paperwork necessary to keep millions of insurance policies in order. About 40 percent of them are secretaries, stenographers, and typists. (See statement on p. 205.) The others have a variety of titles depending upon their assignments. Like office workers in other industries, they may answer telephones, file, route, sort, and perform other duties connected with records and correspondence. Many use adding, calculating, and other machines to figure rates, prepare tables, or list and total data for reports. Some operate key-punch or tabulating machines and, nowadays, a small but growing number work with electronic computers to handle record-keeping on tremendous masses of data. About 85 percent of all clerical workers in insurance companies are women—a higher proportion than in most other businesses.


Clerks in insurance companies use a variety of office machines.

Clerks in home offices, where most clerical work is centralized and specialization is feasible, are generally assigned a few specific duties. In contrast, those in insurance agencies usually perform a variety of clerical operations. A clerk in an agency office may, for example, type agents' reports, use an adding machine, file correspondence, operate the switchboard, and mail policy applications to the home office. Clerks in agencies are usually supervised by the *cashier* (D. O. T. 1–01.52), who also handles premium payments on policies and mails them at regular intervals to the home office. The cashier in a home office is likely to be responsible only for bookkeeping records and money transactions.

Many home-office clerks are concerned with individual insurance policies—copying information on policy forms, checking, and correcting information. Some known as *policy writers* (D. O. T. 1–37.32) type information, such as name, address, amount of policy, and premium rate, from approved application forms to policies. *Policy-change clerks* (D. O. T. 1–08.12) revise policies following instructions from agents as to changes in the beneficiary or in the policy amount. To make sure that work is accurate, several kinds of *insurance checkers* (D. O. T. 1–03.02) are employed, whose titles reflect the type of insurance action that is taken, for example, *policy-change checkers* examine policies drawn up after changes have been made and see that all information has been correctly entered on company records. If a policyholder terminates his policy, a *cancellation clerk* (D. O. T. 1–08.05) types out a cancellation notice, computes the refunds by using a book of tables, sends this information to the bookkeeping department for recording and payment, and mails the canceled policy to the policy holder. *Annuity-record clerks* (D. O. T. 1–08.02) make up cards for new policies and change them whenever necessary. *Underwriter clerks* (D. O. T. 1–05.01) are usually in training for more responsible work; they assist underwriters by performing various clerical duties such as filing and checking applications for errors.

Large numbers of office-machine operators are employed in home offices and, to a lesser extent, in agency offices. In addition to machines commonly

used in many business offices—adding, billing, bookkeeping, addressograph, and mimeograph machines—many insurance companies also use key-punch and tabulating machines. The *key-punch machine operator* (D. O. T. 1–25.62) presses keys on a machine similar in action to a typewriter, except that the key-punch machine makes holes in cards instead of printed letters. The operator follows a special code of instructions to punch holes which represent information about an insurance policy. The key-punch cards are used by *tabulating-machine operators* (D. O. T. 1–25.64) in their work. Tabulating-machines may be adjusted to sort and count various items on the punched cards and may also add, multiply, or make other calculations. After items are printed on sheets by the machine, the operator or an assistant files the cards.

Where Employed

Clerks and office-machine operators are employed mainly in home offices of insurance companies which, as indicated earlier, are concentrated in large cities. Nevertheless, there are some opportunities for employment in agencies in all cities and in many towns of each State. (For additional information see *Where Employed* on p. 500 of this report.)

Training and Other Qualifications

Graduation from high school or business school is adequate preparation for most beginning clerical jobs with an insurance company have an excellent business arithmetic, bookkeeping, and shorthand are generally considered desirable. Training in the operation of office machines, is also valuable, in view of the widespread use of adding, calculating, bookkeeping, and other machines in insurance companies.

Applicants for jobs in insurance companies are usually given an interview and may be given intelligence and clerical aptitude tests. Young people who have worked part time or held summer jobs with an insurance company have an excellent chance of being hired for regular work.

Inexperienced young men and women may start out in a variety of clerical jobs, such as insurance checker, file clerk, and bookkeeping clerk. In some large insurance companies, employees not already trained in office-machine operation can qualify for such work through classes conducted by the company. Employees can also improve their chances for advancement by enrolling in the industry-sponsored educational program of the Life Office Management Association Institute. The courses cover principles of life insurance agency organization, elements of office management, and other phases of the insurance business.

Promotion from a routine clerical job may be first to a minor supervisory position and then to section head. Some companies select promising young clerical workers to train for underwriter or claim adjuster positions. Bookkeeping experience is usually required for advancement to positions as cashier either in a home or agency insurance office. Insurance companies usually follow a "promotion-from-within" policy, taking length of service, on-the-job performance, and leadership qualities into consideration. This policy is also being applied by some companies in selecting workers to fill new and better paying positions in connection with the use of electronic computers. There are some opportunities for outstanding clerical workers to advance to positions as officers, though many insurance companies prefer to hire people with college backgrounds for training as executives.

Employment Outlook

Employment opportunities for clerical workers are expected to be good during the remainder of the 1950's, as the insurance business continues its remarkable growth. Some large insurance companies were having considerable difficulty in 1956 in hiring enough clerical workers to fill vacancies. To meet the shortage, young people aged 16 and 17 were being hired for part-time work, and some people in the older age groups were being employed on a full- or part-time basis. In the late 1950's, a considerable number of new jobs will become available as plans for opening additional insurance agencies are carried out and long-established offices expand. However, turnover—which is high among the many young women employees—will continue to be the major source of job openings.

Over the long run, although clerical work will continue to provide most of the employment opportunities in the insurance business, the number of workers in this occupational group will grow at a more moderate rate than in the recent past. It is expected that the need for clerical employees will be reduced to some extent by the greater use

of the electronic computers in processing data. These machines will displace many clerks, most of whom are now employed in routine jobs, such as sorting or filing records and correspondence, or operating calculating and bookkeeping machines. On the other hand, the introduction of the newer electronic machines will create a number of new and generally more skilled and better paying jobs. In all probability, few, if any, clerks will become unemployed as a result of the installation of new machines. Some insurance companies faced with the necessity of reducing clerical staffs in 1956 met the problem by not filling vacancies arising from normal turnover and by transferring employees elsewhere in the company where help was needed. It is expected that other insurance companies will similarly absorb their displaced clerks.

Earnings and Working Conditions

Clerical workers in beginning jobs, such as office girl and file clerk, had average weekly earnings in 1954–55 ranging from $35 to $50 in finance and related industries (insurance, banks, and real estate) in large cities. (See also earnings table in banking occupations, p. 434.) Typists in entry jobs generally earned between $40 and $50. The weekly earnings of key-punch operators were usually from $3 to $9 higher than salaries of beginning typists, but $1 or $2 lower than earnings of experienced typists assigned to relatively difficult typing work. Secretaries and tabulating-machine operators were generally among the highest paid employees in nonsupervisory jobs. Employees who remain on the job over a period of time, usually receive regular salary increases. The highest pay for most positions in 1954–55 was in the Chicago or San Francisco-Oakland areas, where average earnings ranged from $45 weekly for file clerks to $73 for secretaries.

Most employees in finance and related industries worked fewer than 40 hours a week in large cities during 1954–55. Compared with many other industries, the number of holidays given insurance workers is usually quite liberal; 11 paid holidays are particularly common in the Northeastern States. Two-week vacations after 1 year of service are given by most insurance companies. A number of companies allow 3-week vacations after 10 or 15 years and 4 weeks after 20 or 25 years of service. Life insurance, retirement plans, and hospitalization and surgical benefits are usually granted insurance employees.

Work in insurance companies is generally carried on in clean, well-lighted, and often air-conditioned offices. Many companies have dining rooms for employees, recreation rooms, and lounges. Most clerical jobs require little physical effort and many jobs are suitable for handicapped workers.

Where To Go for More Information

General information on insurance employment opportunities and requirements may be obtained from the personnel department of major insurance companies, from insurance agencies in your local area, or from:

Institute of Life Insurance,
488 Madison Ave., New York 22, N. Y.

Life Office Management Association,
110 East 42d St., New York 17, N. Y.

Life Insurance Agents

(D. O. T. 1–57.10)

Nature of Work

Life insurance agents sell policies that provide life insurance, and retirement protection for individuals and groups. Many of them also sell accident and health policies. Agents are sometimes referred to as life insurance salesmen and may also be called life underwriters, since they frequently play a major role in the underwriting function of judging insurance risks on small policies.

A life insurance agent spends most of his time meeting people in their homes or places of business to explain different types of insurance coverage and policies. Part of the agent's time is spent in his agency office selecting new prospects for insurance sales and planning insurance programs for individual clients. He may also arrange for necessary physical examinations, help clients fill out application forms, assist with benefit claims, and perform other services. Some agents who sell small policies, usually those in amount of $500 or less (called industrial life insurance), are responsible for collecting premiums from policyholders.

Approximately 190,000 life insurance agents (fewer than 5 percent were women) were employed full time in 1955 in selling policies on an individual or group basis. Many were combination agents hired by companies to sell both ordinary life policies (usually in amounts of $1,000 or more) and industrial insurance. Most life insurance agents represent only one company and work in a branch or district office maintained by that company. This working arrangement contrasts with the casualty and fire insurance agent who usually represents several companies.

Unlike most salesmen, who sell goods or property which a buyer can see, the life insurance agent is concerned with selling an idea—one of financial protection. He should be able to explain clearly in nontechnical language the various kinds of policies available, the costs involved, and the benefits provided. Companies frequently evaluate their agents on how long the policies they sell remain in force. Therefore, an agent must try to balance a client's ability to pay against his need for protection and help him make a wise decision. This usually results not only in a more desirable sales record but may bring referrals for new prospects from satisfied policyholders. During the one or more visits required to sell a policy, the agent must establish a personal relationship which inspires confidence in his ability and integrity.

Agents have a great deal of independence and personal responsibility for planning their work. They must build up lists of prospective customers from referrals made by personal acquaintances or satisfied clients, or from other sources. Additional business often depends on the agent's ability to gather as much pertinent information as possible on policyholders—for example, births in a family, purchase of a new home, improvements in income status, or other factors that indicate a prospective sale of additional insurance.

Where Employed

Life insurance agents are employed in agencies located throughout the country. Although the greatest numbers of agents are in States with the most population and in large metropolitan areas, opportunities are increasing in smaller, newly developed areas which have rapidly growing industries and above average increases in population. Agents who sell industrial life insurance are usually assigned exclusive rights to sell weekly premium business for their company in a specified location—called a "debit area"—which is sometimes a small town or a part of a city. (For addititonal information see *Where Employed* on p. 500 of this report.)

Training and Other Qualifications

Most life insurance companies seek mature people, at least 21 years of age, to train as life insurance agents. The applicants must have the aptitude and personal qualities necessary for selling insurance and the ability to grasp insurance fundamentals. Although no formal educational requirements exist, the majority of agents hired in recent years have had some college training and many are college graduates. Many companies prefer persons with some business experience, especially in work where contacts with people are important. Since effective selling often depends on a sound personal relationship between agent and client, the insurance agent who is poised, a patient listener, and able to answer his client's questions simply and clearly has a good chance of success. Clients are more inclined to discuss personal matters related to their insurance needs with agents who display a mature understanding of their problems.

Young people interested in beginning as life insurance agents may apply to agencies in their own communities, where their acquaintances are centered, or they may write to the main offices of insurance companies. In hiring agents, a number of companies, in addition to personal interviews, give tests to determine an applicant's aptitude for selling life insurance. A well-rounded program of on-the-job training and education is conducted by most companies for beginning agents. In addition, agency managers assist agents with their individual problems and may assign experienced agents to do joint selling with newcomers.

An agent must be licensed in each State where he sells insurance. To obtain a license, the agent must be sponsored by the company he represents, which usually pays for the license. Many States issue a preliminary license, and later a permanent one after the agent has gained sufficient knowledge of the insurance business to pass a written examination. In mid-1955, 33 States required agents to pass written examinations which generally include questions on the insurance laws of the State and life insurance fundamentals. Other States

issue licenses without examination, but usually require the sponsoring company to submit statements on matters such as an agent's residence and character.

Agents can continue to broaden their knowledge of the life insurance field by participating in industry-sponsored educational programs. After 1 year of selling experience, life insurance agents can enroll in courses offered by the Life Underwriter Training Council (LUTC). These courses emphasize selling techniques and are designed to improve the students' sales and service ability. More advanced study at the college level is available under the program of another industry-established organization, The American College of Life Underwriters. Agents choose their own method of study—at home, through cooperating colleges and universities, or in company-organized study groups. Candidates who pass required examinations and have 3 years of insurance experience are awarded the designation, Chartered Life Underwriter (CLU) and are eligible to join the American Society of Chartered Life Underwriters. The examinations test the agent's ability to apply his knowledge of life insurance and related business subjects—economics, business law, taxation, trusts and finance—to insurance problems. The CLU designation is recognized as a mark of attainment in the insurance field. In addition to the programs mentioned, other sources through which agents may increase their knowledge include colleges which offer advanced courses in some phases of insurance, special life insurance marketing institutes (located at Purdue and Southern Methodist Universities), and institutes, conferences, and seminars sponsored by various insurance organizations.

Promotion to assistant manager or manager of an agency office usually depends upon demonstrated sales ability and leadership qualities necessary to build and supervise a selling force. Some companies use aptitude tests as a guide in promotions. A few agency managers may advance eventually to regional supervisor of a group of agencies, superintendent of agencies, assistant vice president, or vice president in charge of agencies.

Employment Outlook

Employment opportunities for life insurance agents are expected to be good throughout the remainder of the 1950's and in the early 1960's, assuming that general economic conditions remain favorable. Insurance companies plan a 40-percent overall increase in the number of agencies between 1955 and 1965, and it is estimated that 4,000 to 5,000 full-time agents will be hired, on the average, each year during this period for new positions. In addition, several thousand more agents will be employed annually to replace those who die, retire, or change to other types of work. However, some decrease in the turnover rate among beginning agents is expected as a result of continuing improvements in selection, training, and company salary plans for newcomers. Employment opportunities for agents and agency managers are expected to be particularly numerous in suburban areas of large cities and in cities with less than 100,000 population.

Though the number of life insurance agents will continue to rise over the long run, employment will not increase as rapidly as might be indicated by the anticipated tremendous growth in insurance sales, since individual policies of larger amounts will be sold. Group insurance sales are also expected to become more widespread and to some extent such sales may reduce the need for agents.

The trend toward giving preference to college graduates in selecting insurance agents is likely to continue, and companies are expected to place greater emphasis on in-service training of beginning agents. Nevertheless, industry preference for agents with previous business experience will continue to be a factor favoring the employment of mature workers, and many companies will probably continue to allow older experienced agents to engage in some selling activity after they retire.

Earnings and Working Conditions

Beginning agents, faced with stiff competition from experienced salesmen, are usually financed under company plans for periods up to 3 years. In 1956, over 80 percent of inexperienced agents were estimated to be under financial assistance plans. The average income of inexperienced agents selling ordinary life insurance exceeded $350 monthly in 1956. The continuation of financing arrangements requires that agents sell a specified minimum of insurance.

After the first few years, agents' earnings take the form of commissions representing a percentage of the premiums paid by clients to whom they have sold policies. Usually, a large initial commission

is paid on newly sold policies. Then on all policies which are kept in force, agents receive a small renewal commission each year for several years and, subsequently, they may receive a still smaller annual service fee. As renewal commissions build up over a period of years, an agent's total income increases even if he sells only about the same amount of insurance each year. After 4 or 5 years, an established agent selling ordinary life insurance may earn \$5,000 to \$10,000 a year. The average earnings of combination agents (selling both industrial and ordinary life insurance) in one large company were between \$6,000 and \$7,000 in 1955. The average commission income of approximately 1,200 top agents in the country was \$35,000 per year. Many companies have various kinds of benefit programs for agents employed in branch or district offices—such as life insurance and pensions, and hospital, surgical, and medical benefits.

Agents make several calls a day and frequently use a car in their work. They usually pay their own automobile expenses, although a few companies now pay part of this cost. Sometimes, it is necessary for agents to make evening or weekend appointments for the convenience of clients.

Where To Go for More Information

General information on employment of agents may be obtained from personnel directors of life insurance companies and local organizations of life insurance agents. Information on State licensing requirements may be obtained from the department of insurance at any State capital. Information on life insurance agents is also available from:

Institute of Life Insurance,
488 Madison Ave., New York 22, N. Y.

Life Insurance Agency Management Association,
855 Asylum Ave., Hartford, Conn.

Property and Casualty Insurance Agents and Brokers

(D. O. T. 1–57.10)

Nature of Work

People who sell insurance against property loss or damage are called property and casualty insurance agents. Like life insurance agents, they spend most of their time meeting people to explain policy terms and evaluate insurance needs. Both types of agents must understand insurance fundamentals, and must be able to establish sound personal relationships with clients. In addition, property and casualty insurance agents are often required to be familiar with production processes, the kinds of losses that can occur in industry, and the safety measures used in plants, so that they can explain clearly and simply how much and what kind of insurance may be needed. If they sell workmen's compensation, automobile liability, and other kinds of public liability insurance they must have a knowledge of the various hazards that may cause injury to people for whom the insured is responsible. Agents representing multiple-line companies may sell a single policy which protects the owner of a dwelling or industrial plant against fire, explosion, burglary, and other hazards. The many agents who have contracts as representatives of more than one insurance company must select the particular company that best satisfies the client's needs. Some agents specialize in selling one kind of insurance—for example, accident and health or automobile insurance.

An agent usually spends part of the day in the agency office planning his daily schedule of visits and compiling a list of prospects. He also keeps up-to-date records of his client's needs, as a basis for additional sales, and works out insurance programs adapted to the client's circumstances. The agent who carefully attends to servicing his client's needs, whether he helps him file a benefit claim or suggests the need for additional protection, will establish a successful record of insurance renewals.

Brokers handling property and casualty insurance do not have contracts with any particular company but are independent middlemen who place policies through agents or directly with insurance companies. Clients rely upon the broker's judgment and wide knowledge to select the best financial protection and place their policies with the most suitable companies.

Where Employed

The more than 100,000 property and casualty insurance agents and brokers do business in every section of the country. Widespread ownership of automobiles and homes and continuation of the

trend toward suburban living has created favorable opportunities for agents outside of large cities. Brokers may be located in small as well as large cities, but the largest volume of insurance is handled by brokerage firms in population centers such as New York, Chicago, Philadelphia, and Los Angeles. (For additional information, see *Where Employed* on p. 500 of this report.)

Training and Other Qualifications

An agent or broker must obtain a license in each State where he sells insurance. Two-thirds of the States require agents to pass a written examination which usually covers the insurance laws of the State and property and casualty insurance fundamentals. Other States generally issue licenses without examination upon receipt of statements on such matters as the agent's residence and character.

Newcomers, who usually start by selling the simpler types of policies, may increase their knowledge of the insurance business by experience and by study under company or industry-sponsored programs. Most companies or agencies have some method—ranging from carefully planned training programs to on-the-job supervision—to help new agents get started. Many large companies and agencies prefer to hire college graduates or men with some college training, who can easily grasp insurance fundamentals. It is of special importance to an agent or broker operating his own business to have an expert knowledge of various types of insurance and some background in subjects such as accounting, economics, and business law. Agents who deal with industrial firms benefit from acquiring a knowledge of manufacturing processes, safety methods, and construction problems.

The Insurance Institute of America has an educational program for agents who wish to learn the fundamentals of property and casualty insurance. Certificates are issued to those who pass Institute examinations. Opportunity for advanced study is available through the program of another industry-sponsored group, the American Institute for Property and Liability Underwriters, Inc. Agents can study at home or in classes conducted by colleges, insurance societies, and company groups. Upon the successful completion of 5 written examinations and fulfillment of a 3-year insurance experience requirement, agents receive the designation of Chartered Property Casualty Underwriter (CPCU) and become eligible for membership in the Society of Chartered Property and Casualty Underwriters.

The knowledge gained in acquiring the CPCU designation, a recognized mark of attainment in the insurance field, is valuable to persons interested in becoming brokers or operating an agency—either their own business or one in which they have purchased a partnership share. It may also help one qualify for home office supervisory and executive positions.

Ease in dealing with people is one of the personal characteristics helpful to agents in their contacts with clients. They also need a good sales approach and the ability to explain insurance matters simply and clearly. In addition, since agents are largely responsible for directing and planning their own work, they must be willing to take the initiative in obtaining prospects for sales and in giving service to policyholders.

Employment Outlook

Numerous employment opportunities for property and casulty insurance agents will arise in the late 1950's, assuming that general economic conditions remain favorable. Many new agents will be hired to meet the growing business and individual needs for insurance protection, as discussed in the introductory section of this report. Replacements will also be needed for agents who die, retire, or otherwise withdraw from the occupation.

Jobs for agents will increase with general economic growth, since most businessmen and consumers budget insurance as a necessary expense. In 1956, manufacturers planned a record investment of almost $35 billion in new plants and equipment. Every expansion in business plant or equipment, every home, automobile, or other expensive item purchased by consumers represents a potential sale of insurance for agents. Continued extension of public liability laws, such as workmen's compensation and automobile liability laws, will also create a larger insurance market. Not only will there be a need for additional agents to sell an increasing number of policies, but the greater value of insurance sold by individual agents may result in higher earnings for agents. Although employment prospects are favorable for agents, competition for sales—always keen in the insurance field—will continue to be strong.

In the long run, a growing number of companies and agencies are expected to select college graduates or persons with some college background to train as agents. Greater emphasis will also be placed on in-service training of agents in order to prepare them to handle many different types of insurance. Recent legislation permits companies to include insurance of various kinds in one policy. Beginning agents representing multiple-line companies will therefore be required to have a broad knowledge of the property and casualty insurance field. It may take some time, however, before multiple-line companies become widespread.

Earnings and Working Conditions

Earnings of property and casualty insurance agents are similar to those reported for life insurance agents. The new agent who is establishing himself can usually expect a monthly income of about $350 from commissions or from commissions combined with salary. After a few years, when earnings generally depend on commissions alone, annual income may be $5,000 to $10,000. A small proportion of highly successful agents earn substantially more.

Commission earnings are based upon a percentage of the annual premiums paid by policyholders. The same commission rate paid for new sales applied to renewals, which commonly occur after 3 to 5 years on many property and casualty policies. Automobile insurance is generally sold on a yearly basis. Agents whose work is interrupted by causes such as illness continue to receive commissions if policyholders renew their policies.

The agent or broker who owns his agency must pay his own expenses, like any other independent businessman. Major items frequently are rental payments and clerical salaries, which vary with the size of the agency. Agents generally pay their own automobile or other travel expenses.

Where To Go for More Information

Information on employment of agents may be obtained from most property and casualty insurance companies and agencies. Licensing information may be obtained from the department of insurance at any State capital.

Further information on the property and casualty insurance field is available from:

The National Association of Insurance Agents,
96 Fulton St., New York 38, N. Y.

The National Association of Mutual Insurance Agents,
829 Investment Building, 1511 K St. NW.,
Washington 5, D. C.

Information concerning education in the property and casualty insurance field is available from:

The Insurance Institute of America, Inc.,
3924 Walnut St., Philadelphia 4, Pa.

The American Institute for Property and Liability Underwriters, Inc.,
3924 Walnut St., Philadelphia 4, Pa.

Actuaries

(D. O. T. 0–36.55)

Nature of Work

Actuaries are mathematicians whose main job is to keep insurance plans financially sound. To do this, the actuary must gather and analyze masses of statistical data and be able to explain their meaning clearly and simply. A number of actuaries hold important executive positions and give advice and assistance in practically all kinds of insurance work.

The actuary must evaluate the risks on what is being insured, in order to set the premium rates for different kinds of insurance. He is concerned with losses from death, sickness, and injury and with personal and property losses from fire, burglary, explosions, and other hazards. In his work, the actuary considers the frequency of such losses and their costs. From his continual research, he prepares records on mortality (death) and morbidity (sickness), and computes tables of premium rates and policy values. He is responsible for the analysis of company earnings and often develops general insurance plans and helps in preparing the contract provisions. The actuary must continually study new developments and make revisions whenever necessary. This calls for an understanding of general business trends as well as legislative, social, and other factors that may affect the insurance business.

Because of his broad knowledge of the insurance field, the actuary frequently works on problems in other departments, such as investment, underwriting, and group insurance and pension sales and service. In an important executive position, he

may help decide general company policy and testify before public agencies on proposed legislation or on justification of company rates. He may also prepare articles, press releases, and speeches.

Actuaries employed by the Federal Government usually deal with a particular program such as social security, or insurance for veterans and members of the Armed Forces. In State Governments, actuaries are involved in the supervision and regulation of insurance companies and may work on problems connected with unemployment insurance or workmen's compensation. Consulting actuaries may be hired on a part-time basis to perform any actuarial services that may be required by private prepare articles, press releases, and speeches.

Where Employed

The approximately 1,600 professional actuaries work chiefly in home offices of life insurance companies, which employ roughly four times as many actuaries as property and casualty insurance companies. About 10 percent of all actuaries work for consulting firms or are in business for themselves. The Federal Government employs about 50 actuaries, chiefly in the Department of Health, Education, and Welfare and the Veterans Administration. Most of the remaining actuaries are employed by State Government agencies; a few are with property and casualty insurance rating bureaus.

The size of companies' actuarial staffs depends upon the volume and nature of their insurance work. A few of the largest companies which sell all lines of insurance or have a tremendous group insurance business, each employ as many as 50 to 100 actuaries. Small companies, however, may have only 1 or 2 actuaries on their staffs or may rely entirely on consulting firms for actuarial services. In the property and casualty insurance fields, actuarial services are often shared by a number of companies, through associations specializing, for example, in factory, marine, or aviation insurance.

Training and Other Qualifications

College graduation with a major in mathematics is the generally accepted educational requirement for entry into actuarial work. In addition to courses in higher mathematics—including advanced algebra, differential and integral calculus, descriptive and analytical geometry, the principles of mathematical statistics, probability, and finite differences—courses such as actuarial mathematics and insurance law may be helpful. Various business studies in fields such as economics, investments, and accounting, and courses in English composition and speech may also prove valuable. A well-rounded educational background and the ability to deal with people and to express oneself clearly and simply are important qualifications.

Most actuaries gain professional status after passing examinations in life insurance given by The Society of Actuaries or those in property and casualty insurance given by the Casualty Actuarial Society. An actuary becomes an "Associate" in the Society of Actuaries after completing that Society's first 5 examinations, and in the Casualty Actuarial Society after passing its first 4 examinations. The designation of "Fellow" is conferred after completion of all 8 examinations given by either society. It usually takes more than 5 years to complete the entire series. For the more advanced examinations, experience in insurance work and intensive home study are usually required. It is desirable for students to take some of the early examinations while still in college. Success in these examinations helps the student determine whether he has the ability to become an actuary and greatly increase his opportunities for employment.

In interviewing applicants for actuarial work, company officials evaluate both their mathematical ability and characteristics such as leadership, the ability to deal with people, and an interest in business problems. Preference in hiring is usually given to persons who have passed at least two of the actuarial examinations mentioned above, and to those with part-time actuarial experience.

A beginning actuary is usually rotated through different sections of the actuarial department, so that he can learn the various actuarial processes and become acquainted with different phases of insurance work. At first, the actuarial trainee may make calculations or tabulations for actuarial tables or for the annual statement. Later he may supervise actuarial clerks and be concerned with correspondence and reports.

Advancement to more responsible work as an assistant and later as associate or chief actuary depends largely upon on-the-job performance and passing the actuarial examinations. A number of actuaries, because of their broad knowledge, eventually qualify for high administrative positions in

other areas of company activity, particularly in the underwriting, accounting, or investment departments. A few advance to top executive positions as company vice presidents or presidents.

Employment Outlook

Actuaries are expected to find favorable opportunities for employment continuing into the 1960's. Although the field is small, it is far from crowded. Early in 1956, many insurance companies had unfilled positions for actuaries, and the Federal Government included actuaries in a list of occupations in which there were acute personnel shortages in certain geographic areas. The insurance industry will continue to compete for the limited supply of persons with a strong mathematical background, who are also greatly in demand for jobs in many other industries.

Over the long run, actuarial work is expected to increase with the growth of the insurance industry (discussed in the introductory section). Replacement needs, resulting from deaths, retirements, and resignations, will also provide some openings. More jobs will arise as actuaries in the field need more assistance to handle problems arising from changing and more complex insurance coverages. The fast-growing group life insurance plans, as well as pension plans, will require additional actuarial service. The greater use of electronic data-processing machines by insurance companies will also increase the demand for actuaries who will be needed to help work out complex problems connected with the use of this equipment.

Some expansion in employment of actuaries in property and casualty insurance is also expected, though actuaries in this field will probably remain a much smaller group than in life insurance. Actuaries in the property and casualty insurance field must constantly make studies which are used as the basis for rate changes in the short-term policies typical of this field. They must also present justification for these changes before State regulatory agencies. New "multiple line" selling may eventually lead to larger companies in the property and casualty field and these will require the services of more full-time actuaries.

Employment opportunities will probably continue to be good for the few women who qualify as actuaries. However, women who withdraw temporarily from the labor market because of family responsibilities or for other reasons may find it difficult to complete the years of continuous training and study required to gain full professional status.

Earnings and Working Conditions

Actuarial trainees are generally offered higher starting salaries than most college graduates hired for positions in the home offices of insurance companies. A few large companies paid annual salaries between $4,000 and $5,000 to beginning actuaries in 1956. Persons who have passed some preliminary examinations given by the professional actuarial societies usually receive higher starting salaries. A Fellow of either Society, or a person with comparable knowledge, experience, and ability in actuarial work, may receive $9,000 a year or more. Earnings increase thereafter with experience and added work responsibility. Annual salaries of $25,000 and more may be earned by actuaries in executive positions in large companies.

Actuaries generally work in modern, well-equipped offices, which are adequately lighted and ventilated. They usually work a regular 5-day week averaging between 35 and 40 hours. Insurance companies provide a liberal number of paid holidays and give vacations which are increased with length of service. Actuaries also share in the group insurance and pension plans, as well as in other employee benefit programs offered by many insurance companies.

Where To Go for More Information

Information, particularly on actuarial examinations, may be obtained from the following professional societies:

Society of Actuaries,
208 South LaSalle St., Chicago 4, Ill.

Casualty Actuarial Society,
200 Fourth Ave., New York 3, N. Y.

Additional information is given in:

Educational Requirements for Employment of Actuaries, V. A. Pamphlet 7–8.1, Bureau of Labor Statistics in cooperation with Veterans Administration, 1955. Price 15 cents.

OCCUPATIONS IN THE IRON AND STEEL INDUSTRY

Iron and Steel Industry and Its Workers

Our country's industrial power, the basis for its high standard of living and great military strength, rests largely on iron and steel. The United States produces about half the world's output. This country's 1955 per capita output of steel was estimated at about 1,400 pounds, several times the entire world's average.

One of the Nation's largest employers, the industry had about 660,000 wage and salary workers on the payrolls of its more than 300 plants in mid-1956. The industry employs workers in a great variety of jobs, ranging from highly specialized professional and technical workers to unskilled laborers. Many of the jobs are unique to this industry.

The iron and steel industry consists of plants engaged in a coordinated series of activities: Manufacturing pig iron from iron ore in blast furnaces; converting this pig iron, along with iron and steel scrap, into steel; and rolling or drawing the steel into basic products, such as plates, sheets, strips, rods, bars, rails, tin plate, and structural shapes. In many of the plants, manufacturing processes are carried beyond the rolling stage to produce fabricated products. (The mining of the raw materials is classified as a separate industry, although many mines are owned by steel companies. Plants which are mainly engaged in casting, stamping, forging, or machining steel purchased from steel-producing companies are also not considered part of the basic iron and steel industry.)

Some iron and steel plant products, such as rails, pipe, wire, and nails, can be used directly without further manufacturing. However, the bulk of the products shipped from steel plants, such as sheets, bars, plates, and strips, are further fabricated in plants of other industries into hundreds of different products. The leading steel users are the automobile, construction and building material, machinery, railroad, and container industries. About 4 percent of the steel is exported.

Sheet steel is made into such things as automobile bodies and metal furniture. Bars are used in making various automobile and machinery parts, and in reinforcing concrete in building construction. Plates go into the making of railroad cars, ships, bridges, and heavy machines. Strip steel is used in the manufacture of such products as razor blades, license plates, and toys. Tin plate is used primarily for making containers.

Because the industry deals in large quantity bulk production, it uses huge processing equipment. Blast furnaces are sometimes more than 100 feet in height and 28 feet in diameter, and there may be as many as a dozen in one plant. A single furnace makes up to 350 tons of pig iron each production cycle, which takes about 5 or 6 hours. A typical open-hearth steelmaking furnace is as big as a building 70 feet long and 20 feet wide. Furnaces are loaded by enormous electrically operated charging machines and are emptied by giant crane operated ladles. Raw materials are brought into the plant by railroad car and ship. The rolling equipment which forms the steel into various shapes extends hundreds of feet in length and its height dwarfs the men who handle this operation.

Plants in this industry are typically large. Although some specialized plants employ fewer than 100 workers, more than two-thirds of all the employees in this industry worked in plants with over 2,500 wage and salary workers each in mid-1956. Steel companies differ in the number of operations performed. Integrated companies produce pig iron, make steel, and form steel products by rolling and finishing. Some steel companies operate their own mines. These companies produce the great bulk of the steel and employ most of the workers in the industry. Semi-integrated companies make no pig iron but produce various types of steel from purchased pig iron and scrap. A third group, the nonintegrated companies, purchase steel for their rolling and finishing operations. A fourth type of plant is the merchant blast furnace, which produces pig iron for sale to semi-integrated steel companies and to iron and steel foundaries.

The geographic location of steel plants has been determined by several important factors: The location of their raw materials—coal, iron ore, etc.; the market for their products; and, good transportation facilities.

The steel industry is concentrated mainly in the northern and eastern parts of the United States; the Pittsburgh–Youngstown area is the leading steel center. Further east, are large plants in Buffalo, N. Y.; Johnstown, Bethlehem, and Morrisville, Pa.; and Sparrows Point near Baltimore, Md. The Great Lakes region has many important steel centers, particularly in the Chicago area and Cleveland. Much of the steelmaking in the South is in the Birmingham, Ala., area. As a result of the World War II expansion program, steelmaking capacity has been increased greatly in the Far West; large mills were built in Geneva, Utah, and Fontana, Calif. About three-quarters of the industry's workers are employed in five States (Pennsylvania, Ohio, Indiana, Illinois, and New York). Pennsylvania alone has about a third of the total number of workers.

Jobs In the Industry

More than 1,000 different jobs are found in the plants and offices of the iron and steel industry. The number of wage and salary workers by major occupational group in mid-1956 follows:

Total employment	660,000
Professional and technical workers	30,000
Administrative workers	10,000
Clerical and sales workers	75,000
Skilled workers and foremen	175,000
Semiskilled workers	250,000
Laborers, helpers, and miscellaneous service workers	120,000

The work force of the industry is predominantly male, reflecting both the strenuous nature of some of the production work at present and the hard work under difficult working conditions that formerly characterized steelmaking generally. About 4 percent of the industry's labor force are women, about half of whom work in administrative offices. During World War II, a large number of women entered the industry's plant labor force, and many have remained in such jobs as craneman, machine operator, sorter, and inspector. Negroes constitute about one-eighth of the plant workers. Although a large number work as laborers, many are employed in skilled and semiskilled occupations.

Processing Occupations

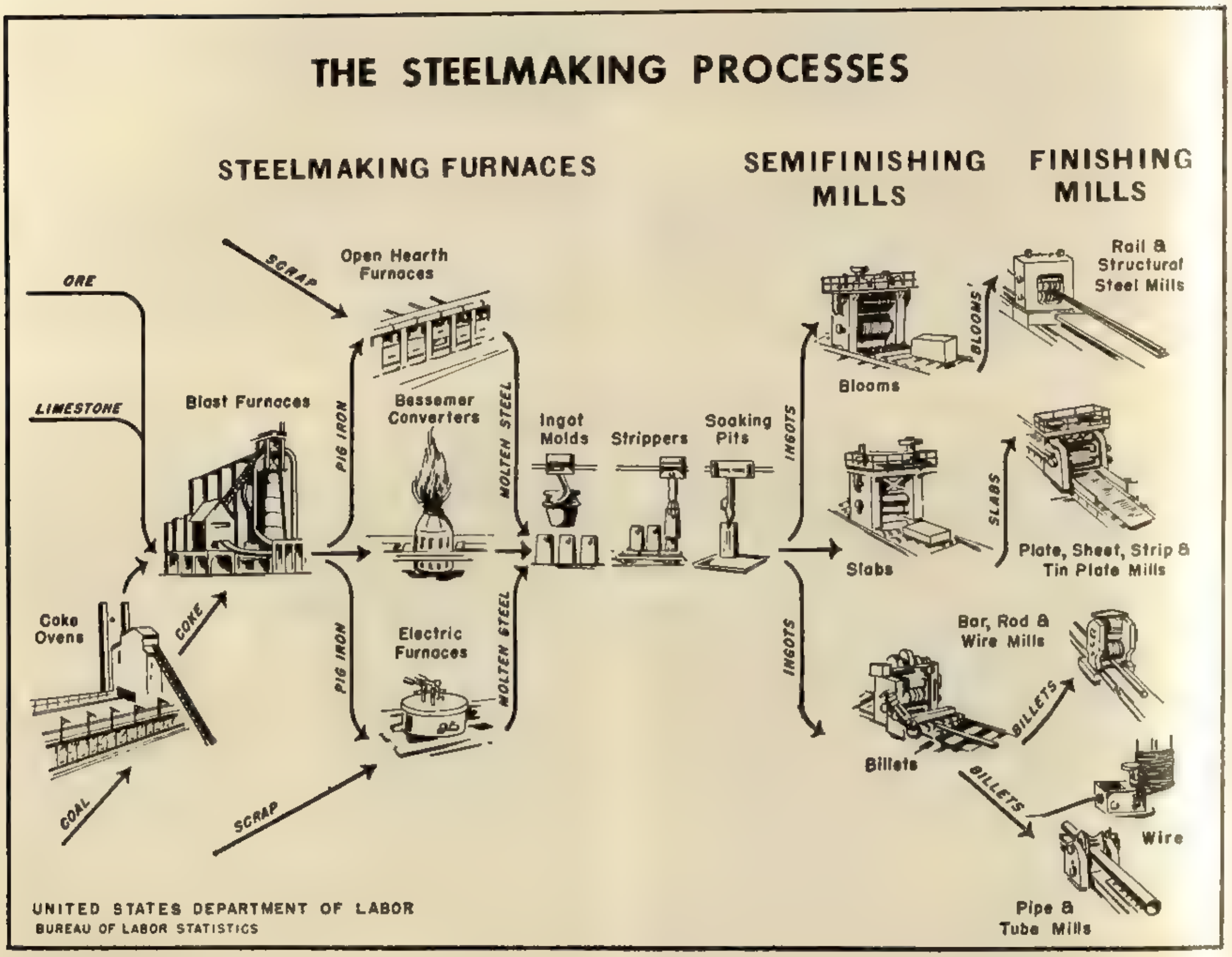
The bulk of the workers in the iron and steel industry are employed in the many processing operations involved in converting iron ore into finished and semifinished steel products, or shapes. Making steel requires three main successive steps: (1) iron is first smelted from iron ore in blast furnaces; (2) then it is converted into steel in steel furnaces; and (3) finally the steel is rolled and finished in steel mills. (See chart 56.)

A picture of steelmaking operations in a fully integrated plant follows with brief descriptions of important occupations as they fit into the production process.

Ore Docks and Stockyards. Most of the ore is brought to plants on the Great Lakes and other waterways mainly by ship from mines in Minnesota and Michigan, as well as from Canada and Venezuela. Giant electric unloaders empty the ore from the vessels; the huge cranes dip down into the holds of the ships, lifting as much as 17 tons of ore at one time. *Ore bridge operators* manipulate electric controls to operate these cranes, known as ore bridges, which move ore and other raw materials from the unloading dock or stockyards to the stock house.

Coke Ovens. Steel companies use coke in their blast furnace operations. Coke is produced by baking coal in ovens heated by gas, but with no flame coming in contact with the coal or coke. The baking removes volatile gases and other impurities from the coal, preventing such impurities from later entering the molten iron in the blast furnace. The coke plant consists of a series of ovens arranged side by side in groups or "batteries." An oven has a door on each end, and openings on top through which the coal is fed, or "charged." A *heater* (D. O. T. 4–56.010) operates a battery of ovens, checking gages, regulating temperature controls, and supervising helpers. When the coal has been converted into coke and the coke is ready to be emptied from the oven, the *pusher operator* (D. O. T. 6–56.030) brings his

CHART 56



pushing machine into place behind the oven. At a signal from the *door-machine operator*, who has removed the door on the discharge side of the oven, the pusher operator opens the door on his side of the oven, shoves out the long arm of his machine, and pushes out the entire contents of the oven into a waiting coke car on a track on the other side. *Car operators* (D. O. T. 6–56.040) operate electrically driven locomotives which move the coke cars to quencher towers where the coke is sprayed with water. Then, after passing over a screen to remove dust and very small lumps, the coke is taken by conveyors to the blast furnace.

Blast Furnaces. The first step in making steel is that of converting iron ore into "pig iron." This process consists of charging alternate layers of coke, iron ore, and limestone into a blast furnace and blowing a blast of very hot air up through the mass. The air blast burns the coke, generating heat and gases which melt the charge and promote the necessary chemical reactions. The gases formed by the combustion of the coke combine with and remove the oxygen from the ore; at the same time, the molten limestone combines with earthy matter in the ore, thus forming scum, or "slag." When the oxygen and slag are removed, molten iron remains.

A blast furnace operates continuously, 24 hours a day, 7 days a week, until it has to be shut down for repairs. Every 5 to 6 hours the molten iron is run off or "tapped." Iron ore, coke, and limestone are charged into the top of the furnace. These raw materials are stored nearby in a stock house below the furnace level. Here *larrymen* (D. O. T. 7–40.050) load "larry cars" with ore, limestone, and coke from the bins, weighing all materials and following prearranged schedules. Then they convey the load through a tunnel to skip cars, which run up inclined double tracks to the top of the blast

Keeper observing molten iron being tapped from a blast furnace.

furnace. Here the skips dump their contents into the furnace. The skip cars are operated by *skipmen* (D. O. T. 5–73.550) stationed on the ground below. *Stove tenders* (D. O. T. 6–91.311) and their assistants operate the huge brick-lined stoves which heat air for the blast furnace. They regulate valves which direct the flow of air into the furnaces and at regular intervals they let cold air into stoves already heated and gas flame into those to be heated.

Blowers (D. O. T. 4–91.311) are responsible for the quantity and quality of iron produced. They supervise the whole blast-furnace operation, including charging and tapping the furnace, and regulating the air blast and furnace heat. Blowers carefully check the metal in the furnace, sampling the molten iron and slag and sending the samples to the laboratory where *metallurgists* make exacting tests and report their findings back to the blower. *Keepers* (D. O. T. 4–91.321), under the direction of the blower, are responsible for the tapping of the furnace. They supervise their helpers and *cinder snappers* in lining troughs and runners through which the molten iron and slag is run off. In integrated steel plants, most of the molten iron is carried by giant ladles to the steel furnaces. Where iron is produced for shipment or for later use somewhere in the plant, it is cast into bars, or "pigs."

Steel Furnaces. The second major step in steelmaking is to convert the iron into ingot steel. About 90 percent of the steel is produced in open-hearth furnaces; about 3 percent is made in Bessemer converters; and 7 percent in electric furnaces. Open-hearth steel is produced by adding pig iron from the blast furnace to steel scrap and limestone and heating the mixture in a furnace. The "open-hearth" is so named because the molten steel lies on the hearth, or floor, of the furnace and is exposed to the flame. The furnaces range in capacity from about 150 to 450 tons of steel at one making or "heat."

A *melter* (D. O. T. 4–91.444) is in charge of the operation of a group of open-hearth furnaces and is responsible for the quality of the steel produced. Each heat of steel is made to definite specifications, so that specific instructions must be followed each time the furnace is charged. The melter must have a practical knowledge of metallurgy; by varying the proportion of the different materials in the furnace and by adding such elements as carbon, manganese, phosphorus, or sulphur, he makes the steel to order. Melter's helpers of different ranks—first (D. O. T. 4–91.445), second (D. O. T. 6–91.183), and third, work under the direction of the melter. These helpers regulate furnace temperatures, take samples for laboratory

A first helper guiding an overhead crane operator in pouring molten metal into an open hearth furnace.

tests, and direct the charging of various materials. A first helper is in charge of one open-hearth furnace.

Charging-machine operators (D. O. T. 6–91.181) run electrically controlled machines which pick up boxes full of limestone, scrap, and other materials; they push the boxes through the open furnace doors, and dump the materials into the furnaces. *Molten metal cranemen* (D. O. T. 5–73.030), operating large overhead cranes, pick up ladles full of molten iron (which has been brought over from the blast furnaces) and pour the contents into the furnaces.

After 8 to 12 hours, the heat of steel is ready to be tapped. A second melter's helper, assisted by a crew of *cinder* pitmen, knocks out a plug at the back of the furnace, allowing the molten metal to flow into a ladle which is just large enough to hold the heat of steel, so that the slag which floats to the top, overflows into a smaller ladle. The third helper assists the first and second helpers in their varied duties.

The liquid metal is then poured from the ladle into ingot molds. A *ladle craneman* (D. O. T. 5–73.030) operates an overhead crane; the crane picks up the ladle and moves it over a long line of ingot molds (hollow cast iron forms) standing on flat bottom cars. The *steel pourer* (D. O. T. 4–91.651) works a stopper on the bottom of the ladle to pour steel into the molds.

As soon as the steel in the ingot molds has solidified sufficiently, *ingot strippers* (stripper-cranemen) (D. O. T. 5–73.010 and 5–73.020) remove the molds from the ingots. They operate a crane which grasps lugs on top of the mold and pulls off the mold, leaving the stripped ingot standing to cool.

In addition to the open-hearth furnaces, steel is made in Bessemer converters and in electric furnaces. In the Bessemer process, the molten pig iron is refined into steel by blowing air through it, thus burning out undesirable elements. The converter, a pear-shaped steel vessel lined with fire brick, is tilted horizontally to receive its charge of molten iron. The converter is swung slowly upward, and at the same time air is forced into the molten iron.

A *blower* (D. O. T. 5–92.302) is in charge of the operation of the Bessemer converter. He directs a *regulator* (D. O. T. 6–91.381) in charging the converter and starting the air blast. During the blast, the blower determines the condition of the steel by means of instruments. He shuts off the blast at the right moment and tilts the converter. He directs the regulator in pouring the metal from the converter into a ladle for "teeming" (pouring) into ingots.

Highest quality steels are generally produced in electric furnaces, in which melting and refining can be most closely controlled. Electric furnaces are steel shells lined with heat-resisting brick. Carbon electrodes project through the roof of the furnace; a powerful electric current "arcing" from one of these electrodes to the other provides heat for refining. The raw material is usually selected steel scrap, although Bessemer or open-hearth steel may be used. During refining, the required alloys are added and impurities are carried off into the slag.

Rolling and Finishing. The final step in the production of steel is shaping. The three principal methods of shaping metal in steel plants are casting, forging, and rolling. Casting, done in foundries, consists of pouring molten metal into a mold and letting it harden into the shape of the mold. Forging involves heating the metal to soften it and then pounding or squeezing the metal into the desired shape. Although a considerable amount of forge shop and foundry work is carried on in steel plants, the bulk is done in other industries.

Rolling is the principal method of shaping steel. It is estimated that four-fifths of all steel products pass through a rolling mill at some stage of their manufacture. (Incidentally, the word "mill," as it is used in the steel industry, may mean an entire plant, one department of that plant, or just one stand of rolls.) The purpose of rolling is to improve the quality of the steel as well as to form it into desired shapes. In passing between the rolls, the steel is squeezed longer and flatter, in much the same way as pie crust dough is kneaded and rolled out.

Before the ingots are rolled, they are heated to the required uniform temperature; the heating is done in large furnaces called "soaking pits." A *heater* (D. O. T. 4–88.081) controls the soaking pit operation. He directs helpers in heating the ingot to the temperature specified by the plant's metallurgical division and, by observing the color of the steel, determines when it is ready for rolling. A *soaking pit craneman* operates a crane to lift the ingot from the soaking pit and deposit it on a

A roller and several assistants operating rolling equipment in a strip mill.

flat-bottom steel carriage, on which the ingot is brought to the semifinishing mill.

In the semifinishing mills, ingots are rolled into blooms, slabs, and billets. These forms are generally square or rectangular in shape. Blooms are generally more than 6 inches wide and 6 inches thick. Slabs are rolled much wider and thinner than blooms. Billets are the smallest of the three. Later, in the finishing mill, blooms, slabs, and billets are made into finished steel products.

The rolling of blooms illustrates the semifinishing process. In the blooming mill, as in other rolling mills, the steel is moved along on a roller line conveyor. A whistle is sounded telling the *roller* (D. O. T. 5–92.301), the man in charge of the mill, that the ingot is on the conveyor. The roller and his assistants operate the roller line and the mill, controlling the speed and direction of the ingot as it passes back and forth through the mill. The mill functions like a giant clothes wringer pulling the hot steel through the mill. After each "pass" through the mill, the rolls are brought closer together making the ingot thinner and longer. Every second "pass" or so, the ingot is turned on its side so that its edges are also rolled.

A roller works in a glass-enclosed "pulpit" above the roller line. His duties, which appear to consist principally of moving levers and pushing buttons, look relatively simple, but actually the quality of the product depends to a large extent upon his skill. One of his principal duties is to regulate the distance between the rolls after each pass. This requires long experience and a knowledge of steel properties. (Too much pressure on the roll may result in cracks or tears in the steel, strain in its tensile strength, or breaks in the roll. Too little pressure may result in too long a rolling period, so that the steel may cool below proper rolling temperature.) A *manipulator* (D. O. T. 4–88.012) sits in the pulpit with the roller and operates some of the controls. After perhaps 20 passes, the bloom is sent along the conveyor to a place where *shearmen* (D. O. T. 6–88.664) use heavy hydraulic blades to cut the steel into proper lengths.

The principle of rolling is essentially similar in all mills. Blooms and other semifinished products are further processed by rolling and other finishing operations in the various finishing mills. Making rails is one example.

In a rail mill, the bloom goes through a number of stands of rolls, beginning with "roughing stands." These stands, operated by a *rougher* (a kind of *roller*), form the bloom into the rough shape of the rail. *Levermen* (D. O. T. 6–88.032) operate the tables raising and lowering the blooms. *Assistant rollers* position the iron guards that direct the partly finished rails into their proper niches between the rolls.

From the roughing stands, the steel goes through five or more other stands equipped with grooved rolls. In each stand, the steel becomes longer and closer to its final shape until it passes through the last stand where it becomes a finished rail. *Hot saw operators* (D. O. T. 6–88.652) operate circular saws which cut the rails to proper length.

One of the outstanding improvements in steel technology, introduced about 30 years ago, is continuous rolling. Briefly, this consists of arranging a number of rolling-mill units in tandem, so that finished steel products can be made without breaking the continuity of the operation. Continuous hot-strip mills are a good example of this process.

In these mills, slabs from the semifinishing mills are reheated, then passed through roughing stands where they are reduced in thickness and increased in length. The steel then passes through a series of rolling stands, each driven separately and timed to roll the strip faster and faster as it becomes thinner and longer. As it races from the last stand, the long strip of steel may be cut up automatically into sheets, which are cooled and stacked in piles, or it may be mechanically wound onto

A speed operator (one type of roller) oversees the action of a butt weld pipe mill while a helper knocks off scale.

reels. Rollers are in general charge of all strip rolling and related operations. *Speed operators* (D. O. T. 4–88.012) coordinate the speeds of the different mill stands to maintain proper tension of the strip. *Coiler operators* by means of electrical controls, operate the machines which coil the hot strip coming from the mill.

An important finishing operation in steel plants is the making of tinplate. Tinplate is actually steel with a thin coating of tin. Tinplating is primarily carried out by an electrolytic process in which the steel goes through a tank containing a tin solution charged with electric current. Action of the electricity causes a coating of tin to be deposited on the steel. Both sides of the tin-plated steel sheet are carefully inspected for defects and sorted by thickness. Many of the inspectors and assorters are women.

Another specialized steel product made in finishing mills is wire. Wire is drawn from a rod, which is rolled from a billet in a rod mill. The wire-drawing process consists of drawing or pulling a rod through a series of dies; the hole of each successive die is smaller than the rod or wire passing through. After each trip through a die, the rod or wire loses some of its thickness, but is lengthened proportionately. *Wire drawers* (D. O. T. 4–88.511) use tongs to pull a tapered rod through the die hole. Then the tapered end is fastened to a reel which starts to turn, pulling the rod through the die and also winding the wire onto the reel. Continuous wire drawing, similar in principle to continuous rolling, is also used to make wire. The wire is drawn, without interruption, through a series of dies, becoming thinner and longer as it goes through each die.

A substantial part of the industry's production capacity is in pipe and tube manufacturing facilities. There are two principal pipemaking methods, seamless and welded. To manufacture seamless pipe and tube, a solid round steel bar, called "a tube round," first is heated to rolling temperature. The bar is moved lengthwise through the rolls, during which time the combined rolling action and roll pressure tends to open the round at its center. A *piercer operator* running a piercer machine, which consists of two barrel-like rolls having between them a long bar with a bullet-shaped nose called the "piercer," completes the hollowing action by pushing the piercer through the opening forming in the tube center. The result is a tube without seams. *Rollers* (D. O. T. 4–88.313) operate the seamless pipe mills; they control the pressure of the rolls which determines length of pipe and thickness of the pipe wall.

A still important, although declining, method of making small size pipe is the continuous butt weld method. Skelp (narrow, flat strip steel) is heated to a welding temperature and then is rolled into a cylinder. It then passes through a welding bell which fuses together the edges of the cylinder. Another weld method is the electric weld in which pipe is made in sizes up to 150 inches in diameter. After the metal is formed into a cylindrical shape by rolling, the edges are welded with an electric-fusion welding machine. *Welders* direct, and work with, a crew to form the pipe from the strip or plate by these welding processes.

Mechanical, Transportation, and Plant Service Occupations

Large numbers of workers are required in steel mills to maintain and repair machinery and equipment; to provide power, steam, and water; to move material and supplies; and to perform a variety of other maintenance and service operations.

In the machine shops, *machinists* and *machine-tool operators* make and repair metal parts for machinery or equipment. *Die makers* use machine tools to construct dies used in wire and cold-drawing units. *Roll turners* (D. O. T. 4–78.011) use lathes, grinders, and other machine tools to finish

steel rolls to desired shape and size for use in the rolling mills.

Millwrights install and help to maintain mechanical equipment. One of their functions is to set up new machinery and equipment. They also dismantle machinery and repair and replace defective parts. *Electricians* install electric wiring and fixtures and "hook up" electrically operated equipment. *Electrical repairmen* keep wiring, motors, switches, and electrical equipment in good operating condition and make repairs when equipment breaks down.

Bricklayers (D. O. T. 5–24.130) repair and rebuild the brickwork in furnaces ,soaking pits, and coke ovens. *Pipefitters* lay out, install, and repair piping. *Boilermakers* test, repair, and rebuild various types of pressure vessels such as heating units, locomotive boilers, storage tanks, stationary boilers, and condensers. *Locomotive engineers* and other train crew members operate steam, Diesel, or electric locomotive-driven trains used to transport materials and products in the vast yards of iron and steel plants. *Welders* operate welding equipment to join together metal parts in repairing and rebuilding plant machinery. Skilled workers run the various boilers, turbines, and switchboards in the powerplants which provide the large amounts of power needed in steelmaking.

Many *laborers* are employed to load and unload materials and do a variety of cleanup operations. Other maintenance and service occupations found in steel plants include *carpenter*, *craneman*, *oiler*, *painter*, *instrument repairman*, *scale repairman*, *loader*, *rigger*, *greaser*, *janitor*, and *guard*.

(Detailed descriptions of the duties, training, working conditions, and job prospects in many of the mechanical, transportation, and service occupations, such as boilermaker, bricklayer, die maker, carpenter, electrician, machinist, millwright, welder, and pipefitter are included elsewhere in this Handbook. See index for page numbers.)

Technical and Office Occupations

The technical and office occupations make up an important part of the industry's labor force. The 30,000 technical workers, about 4 percent of the total employment in the industry, apply scientific knowledge to developing and preparing a variety of metals for many different uses and devising highly complex processes for making these metals. One important phase of the industry's work is the continuing research which makes it possible to keep down the cost of steel, improve its quality, and maintain and even expand the industry's markets by developing special types of steel needed in modern industry. It is estimated that about 15 percent of the industry's technical personnel are engaged in research.

The technical specialists include *mechanical engineers* whose principal work in iron and steel plants is in the design, construction, and operation of mill machinery and material-handling apparatus. Many mechanical engineers work in operating units where their jobs include, for example, determination of roll size and contour, rolling pressures, and operating speeds. Others are responsible for plant and equipment maintenance. *Metallurgists* and *metallurgical engineers* work in laboratories and in production departments where they have the important task of testing and controlling the quality of the steel during its manufacture. *Civil engineers* are engaged in the layout, construction, and maintenance of the steel plant and its utilities, equipment, and roads. *Electrical engineers* design, lay out, and supervise operation of electrical generating and distribution facilities which provide the power essential in modern steel mill operation. They are concerned also with the operation of electrical machinery and control equipment. *Chemists* work in the laboratories, making chemical analyses of steel and raw materials used in steel manufacture. *Laboratory technicians* do routine testing and assist chemists and engineers. *Draftsmen* prepare working plans and detailed drawings required in plant construction and maintenance. (A more detailed discussion of engineers, scientists, and technicians is given elsewhere in this Handbook. See index for page numbers.)

About 10,000 of the industry's workers are in managerial and supervisory jobs, and about 3,000 are in sales positions. The industry has, in addition, a full complement of administrative workers, such as *office managers*, *purchasing agents*, *accountants*, *auditors*, and *personnel workers*. More than 70,000 of the industry's employees are clerical workers. Among these are *secretaries*, *stenographers*, *typists*, *account clerks*, and *general office clerks*. (Discussion of these jobs can be found elsewhere in this Handbook. See index for page numbers.)

Training and Other Qualifications

New workers for processing jobs are nearly always brought in at the unskilled level, either as laborers or as learners in one of the operating units. Openings in higher rated jobs are filled by upgrading. Training for processing occupations is done almost entirely on the job, with the worker progressively moving to operations requiring greater skill as he acquires experience and "know-how." A craneman, for example, is first taught how to operate relatively simple cranes, and then advances in several steps to cranes much more difficult to run, such as the hot-metal cranes.

Generally, steel companies prefer that new process workers have some high school education. To advance in their work, many workers take part-time courses in such subjects as chemistry, physics, and metallurgy. In many cases, this training is provided by the steel companies and may be given within the plant. Other workers take evening courses in high schools, trade schools, and universities in their communities or enroll in correspondence courses.

Workers in the various operating units usually advance along fairly well defined lines of promotion within their departments. Seniority and performance on the job are factors in upgrading. The following illustrates possible lines of advancement in the various operating units:

To become a blast furnace blower, a worker generally starts as a laborer, advancing to cinder snapper, keeper's helper, keeper, blower's helper, and finally blower. In the open-hearth departments, a man may begin by doing general cleanup work around the furnace and then generally advance to door operator, cinder pitman, third helper, second helper, first helper, and eventually, to melter. A possible line of progression for a roller in a finishing mill might be pitman, roll hand, manipulator, rougher, and finish roller. A worker may reach skilled jobs, such as blower, melter, and roller (which are among the highest rated steelmaking jobs), in a minimum of 4 or 5 years, but usually a much longer time is required.

Experienced craftsmen, such as machinists, boilermakers, pipefitters, and electricians, are sometimes hired directly by steel companies. Generally, however, openings in the skilled maintenance occupations are filled from within. Most plants conduct some type of apprenticeship program to meet the needs of their maintenance shops. The apprenticeship programs usually cover 3 or 4 years and consist mainly of shop training in various aspects of the particular jobs. In addition, classroom instruction in related technical subjects is generally given, either in the plant or in local vocational schools.

Qualifications for apprentices vary among companies. Generally, the apprentice must be a high school or vocational school graduate. In most cases, the minimum age is 18 years; usually an upper age limit of 26 or 30 is specified. Some companies give aptitude tests to applicants for apprenticeship to determine their suitability for the trade. Apprentices are generally chosen from among qualified young workers already employed in other plant jobs. The following occupations are among those most often included in apprentice training programs in iron and steel plants: armature winder, blacksmith, boilermaker, bricklayer, coremaker, carpenter, electrician, machinist, molder, pipefitter, rigger, roll turner, sheet metal worker, tool and die maker, and welder.

Semiskilled maintenance jobs are generally filled by upgrading laborers or helpers. Inexperienced workers are hired as laborers. Some of these workers stay in labor jobs indefinitely; others advance to higher rated maintenance or processing jobs.

The minimum requirement for engineering jobs is a bachelor of engineering or a bachelor of science degree from a recognized college. Some companies have formal training programs for college trained engineers in which the trainees work for brief periods in various operating and maintenance divisions to get a broad picture of steelmaking operations before assignment to a particular department. In other companies, the newly hired engineer is assigned directly to a specific research, operating, or maintenance unit. Engineering graduates are frequently hired for sales work and many of the executives in the industry have engineering backgrounds. (Training and other qualifications for engineering and scientific occupations are given in the sections covering the individual occupations. See index for page number.) Graduates of business administration and liberal arts colleges are employed for jobs in sales, accounting, and labor relations, as well as in managerial positions.

Completion of a business course in high school, junior college, or business school is usually preferred for entrance in most of the office occupa-

tions. Generally, office jobs requiring special knowledge of the steel industry are filled by upgrading personnel already employed in the industry.

Employment Outlook

The basic iron and steel industry is expected to hire many thousands of new workers during the late 1950's and the 1960's. Most job openings will arise from replacement needs. Because of the great size of the steel industry's labor force, death and retirement alone should create about 12,000 to 15,000 openings annually during this period. Many other new workers will be needed to replace steelworkers who transfer to other fields of employment. In addition, continued rapid increase in demand for steel products and the resulting expansion in steel capacity and output will result in a slowly rising level of employment.

The steel industry has shown a long-range upward trend in production and capacity, although it has experienced wide fluctuations because of war and sharp changes in general business conditions. The level of steel output in 1955 was more than five times that of 50 years earlier (table 1). The industry's growth has been fairly rapid in recent years. Although the growth of the United States population has been a factor contributing to the growth in this industry, a much more important cause has been the great expansion in the use of steel in our economy. A few figures illustrate this fact: Between 1905 and 1955 the population of the United States increased about 100 percent, whereas steel production increased 422 percent. Per capita steel output, therefore, rose 160 percent during this period. The growth in per capita output has been the result primarily of the rise of the great steel-using industries—automobiles, construction, containers, electrical appliances and equipment, and machinery manufacturing.

TABLE 1.—*Steel production and capacity*

[Thousands—net tons]

Year	Production	Capacity
1905	22, 427	----------
1910	29, 226	----------
1915	36, 009	46, 249
1920	46, 183	60, 220
1925	49, 705	65, 962
1930	44, 591	71, 042
1935	38, 184	78, 452
1940	66, 983	81, 619
1945	79, 702	95, 505
1946	66, 603	91, 891
1950	96, 836	99, 983
1955	116, 500	125, 828
1956	115, 000	128, 363

SOURCE: Annual Statistical Report, American Iron and Steel Institute, 1955, for years 1920 through 1955 (p. 51). Annual Statistical Report, American Iron and Steel Institute, 1948, for years 1905 through 1915 (p. 29).

A continued rapid rise in steel production is anticipated. One reason for this is the expected rise in population from an estimated 169 million at the end of 1956 to about 205 million in 1970. A continued rise in per capita use of steel is also expected. The principal steel-using industries have generally favorable long-run prospects. In the 10 years from the end of World War II, steel capacity had increased about 40 percent. Indications are that an increase of similar magnitude is in prospect for the 1956–66 decade. Despite the rapidly growing output and the expanding range of uses of aluminum and plastics, these materials are not likely to seriously affect the demand for steel.

The expected large increase in steel capacity and output will not result in a corresponding growth in employment. The industry has a long history of increasing output per manhour resulting from the development of new techniques, the increasing use of power equipment, and the better utilization of manpower. For example, whereas steel output increased about 35 percent between 1947 and 1955, employment increased by only 8 percent. Because of this continued increase in output for employee, only a relatively small growth in employment is anticipated during the 1956–66 decade.

There is reason to believe that the future will bring further substantial increases in output per manhour. Several important technological developments in steelmaking are now in various stages of application. Coal washing, for example, speeds up operation of coking ovens and improves the quality of the coke; the higher grade coke raises blast furnace output. Greater air pressure is being used in blast furnaces to increase pig iron production. Feeding oxygen into open-hearth and electric furnaces reduces melting time requirements in steelmaking. The trend toward greater speed in the rolling process permits increased production per manhour. New inspection methods

and instrumentation are being developed which will improve the rate and efficiency of determining the quality of the steels as they are processed. The direct production of steel from iron ore, continuous casting of billets, and extrusion of steel shapes, although still experimental, promise to increase steelmaking efficiency.

Some technological developments, however, having to do with the improvement of the quality of steel may require more, rather than fewer, workers in some operations. Furthermore, there is a trend toward relatively greater increases in output of lightweight sheet which requires more labor time per ton than is required for heavier products such as plate.

Some changes in occupational distribution of employment in the steel industry seem likely. A continuation of the recent trend toward a relatively greater percentage of administrative, technical, and supervisory employees (nonproduction workers) is indicated. Between 1947 and 1955, the number of nonproduction workers in the industry increased about 25 percent, whereas employment of production workers rose by only 5 percent. Increasing use of technical workers can be expected. Engineers, chemists, laboratory aids, and other technical personnel will increase as a proportion of the industry's work force. Among production workers, the number of skilled maintenance workers, such as electricians, maintenance mechanics, and machinists, is expected to increase more than proportionately as a result of the industry's expanding use of complicated machinery and equipment. A continued decline in the number of less skilled processing workers is anticipated.

Earnings and Working Conditions

Earnings of plant workers in iron and steel establishments are among the highest in manufacturing. In June 1956, earnings of production workers in these plants averaged $100.94 a week and $2.48 an hour. This compares with the $79.19 weekly and $1.97 hourly earnings for production workers in all manufacturing.

Earnings vary considerably among the many occupations. Tables 2 and 3 show standard hourly rates in selected occupations based on the wage agreement effective July 1, 1957, between the United Steelworkers and the steel-producing subsidiaries of the United States Steel Corporation (the largest single steel company). These rates are representative of those throughout the industry. Process workers paid on an incentive basis (over 50 percent of all processing workers) generally earn more than these standard hourly wages, but the standard rate serves as a guaranteed minimum for the incentive worker.

TABLE 2.—*Wage rates in processing jobs, iron and steel industry, July 1957*

Processing job	Job class	Hourly rates
Coke Plants		
Heater	18	$2.930
Pusher operator	12	2.540
Door machine operator	11	2.475
Car operator	7	2.215
Blast Furnaces		
Blowers	26	3.450
Keeper	14	2.670
Stove tender	14	2.670
Bucket operator; unloader, docks	13	2.605
Ore bridge operator	12	2.540
Iron pourer; pig machine operator	10	2.410
Larryman	10	2.410
Skipman	10	2.410
Keeper's helper, first	9	2.345
Cinder snapper	6	2.150
Steelmaking		
Blower, bessemer converter	26	3.450
Melter's helper, first, open-hearth	23	3.255
Charging machine operator, open-hearth	16	2.800
Ladle craneman, open-hearth	16	2.800
Pourer, first casting man, open-hearth	16	2.800
Melter's helper, second, open-hearth	15	2.735
Charging floor craneman, open-hearth	13	2.605
Ingot stripper, open-hearth	12	2.540
Cinder pitman, open-hearth	6	2.150
Rolling and finishing mills		
Roller, blooming mill	26	3.450
Butt welder, pipe and tube (1st welder No. 2 butt welder)	21	3.125
Heater, soaking pits	18	2.930
Roll engineer, slab mill	16	2.800
Rougher, hot strip mill	15	2.735
Guide setter, rail mill	14	2.670
Pulpitman; speed operator, finish, hot strip mill	14	2.670
Manipulator, blooming mill	13	2.605
Hot saw man, rail mill	12	2.540
Leverman, first roughing, rail mill	12	2.540
Pickler, sheet batch, tin plate	11	2.475

TABLE 2.—*Wage rates in processing jobs, iron and steel industry, July 1957*—Continued

Processing job	Job class	Hourly rates
Rolling and finishing mills—Continued		
Coiler operator, hot strip continuous mill	11	$2.475
Shearman, blooming mill	10	2.410
Pierce operator, pipe and tube	10	2.410
Wire drawer, continuous, wire mill	8	2.280
Wire drawer, bull blocks, wire mill	8	2.280
Assorters, tin plate	5	2.085
All departments		
Laborer, assigned, such as pig machine laborer or wharfman	3	1.955
Janitors	2	1.890

For a number of years, agreements between the major steel companies and the United Steelworkers of America have included provisions for vacation, retirement, unemployment, sick and accident insurance, and disability benefits. As of the fall of 1956, most workers received paid vacations ranging from 1 to 3 weeks based on length of service. Retiring workers are eligible for a combined company-paid and social-security pension. Generally, as of November 1957, retiring workers 65 years of age with 30 years' service are eligible for a pension of $180.50 a month. Most workers are eligible for supplemental unemployment benefits for up to 52 weeks beginning September 1957. Other important provisions include a $90 monthly disability pension provided by the company and life insurance, accident, sickness, and hospitalization benefits financed jointly by the company and the worker.

Because steel mills have many different operating and maintenance units, working conditions vary greatly. Much of the strenuous nature of steelmaking jobs has disappeared with the mechanization of the steelmaking process. Maintenance shops generally are clean and cool. Rolling mills, however, are generally hot and noisy. Some of these plants, therefore, are developing methods to reduce job discomfort. For example, the use of remote controls enables employees to work outside the immediate vicinity of processing operations. In other instances, the cabs of the mechanical equipment in which the men work are air conditioned. Much of the work in cokemaking still is physically wearing and requires exposure to heat and dirt. Some of the workers near the blast and steel furnaces are exposed to considerable heat. Because certain processes are operated continuously, some workers are on night shifts or work weekends.

The iron and steel industry is a leader in the development of safety programs for workers, emphasizing the use of protective clothing and guard devices on machines to prevent accidents. In 1955, steel plants had an injury rate (injuries per million hours of work) of 4.9 compared with 12.1 for all manufacturing. All but a small proportion of plant workers in the iron and steel industry are members of the United Steelworkers of America.

TABLE 3.—*Wage Rates*

Mechanical, transportation, and plant service jobs, iron and steel industry, July 1957

Job title	Job class	Hourly rates
Toolmaker	18	$2.930
Electrician, first class	16	2.800
Machinist	16	2.800
Boilermaker	15	2.735
Bricklayer, A	15	2.735
Roll turner	15	2.735
Electrical repairman, A	14	2.670
Millwright	14	2.670
Rigger, A	14	2.670
Welder, A	14	2.670
Pipefitter	13	2.605
Carpenter	13	2.605
Locomotive engineer	11	2.475
Painter, A	11	2.475
Switchman	7	2.215
Oiler and greaser, mill oiler	6	2.150
Carpenter helper	5	2.085
Bricklayer helper	3	1.955
Janitor and sweeper	2	1.890

OCCUPATIONS IN THE MEN'S TAILORED CLOTHING INDUSTRY

The Men's Tailored Clothing Industry and Its Workers

The men's tailored clothing industry employed about 120,000 workers in mid-1956 to make the suits, sport coats, topcoats, and overcoats worn by more than 70 million American men and boys. In 1955, this industry produced nearly 60 million garments, valued at more than a billion dollars. Some of the jobs in this industry can be learned in a few weeks; others can be filled only by persons who have had several years of experience or training.

Nature and Location of the Industry

The men's tailored clothing industry, as described in this chapter, includes only establishments primarily engaged in manufacturing men's and boys' tailored suits, sport coats, topcoats, overcoats, and uniforms. Plants whose principal products are slacks, work garments, sport apparel other than coats, and cotton garments are not considered part of the men's tailored clothing industry, although they employ workers with similar skills.

About 90 percent of all men's and boys' tailored clothing is made by ready-to-wear manufacturers. Their products are sold in retail stores where customers may select a garment from an assembled stock of suits and coats. There are three types of ready-to-wear clothing plants. The most important is the "inside shop" which performs all, or nearly all of the manufacturing processes on its premises. Such shops employ a majority of the industry's workers. A few of the largest inside shops own chains of retail stores which market their entire output. A second type of manufacturer (cutter-up) buys and cuts cloth and delivers it to independent contract shops which make up the garments for an agreed price. Since a "cutter-up" contracts most of the work involved in assembling the garment, this type of manufacturer provides employment for only a small number of workers. The third principal type of ready-to-wear clothing establishment is the "contract shop" which specializes in performing one or more tailoring operations for manufacturers. Three out of ten of the industry's workers are employed in contract shops.

In addition to ready-to-wear plants, there are tailor-to-the-trade firms which make garments to order for stores which take individual orders from customers. These stores take the measurements of the customer and transmit the order to the tailor-to-the-trade manufacturer. The tailor-to-the-trade firms employ about 1 out of 10 of the total working force of the industry.

Most clothing firms are small or medium size. Of the almost 1,500 establishments in the industry, less than 45 had more than 500 workers on their payrolls in mid-1956. More than 60 percent of the industry's employees are women. Most of the women in the industry are employed as sewing-machine operators. Others work in such plant jobs as thread trimmers and hand finishers, as well as in office occupations. With the exception of the New York metropolitan area, all manufacturing centers employ more women than men.

The industry is concentrated in a few States. Approximately 30 percent of the workers were employed in New York State in mid-1956. Other States with large numbers of the industry's workers were: Pennsylvania, Illinois, Maryland, Ohio, Massachusetts, and New Jersey. More than one-fifth of the workers were employed in the New York City metropolitan area. Other important centers were Philadelphia, Chicago, Baltimore, Rochester, Boston, Cincinnati, and Cleveland. Contract shops are mainly located in areas in and adjacent to New York City, Philadelphia, and Baltimore.

How Men's Tailored Clothing Is Made

More than 150 distinct operations are required to make a suit, and more than 75 to make a topcoat. Some small firms frequently combine several of these operations into a single job. Suits and topcoats are sometimes made in the same plant, but usually a manufacturer specializes in producing one or the other. Most plants contract out part of their operations, such as the manufac-

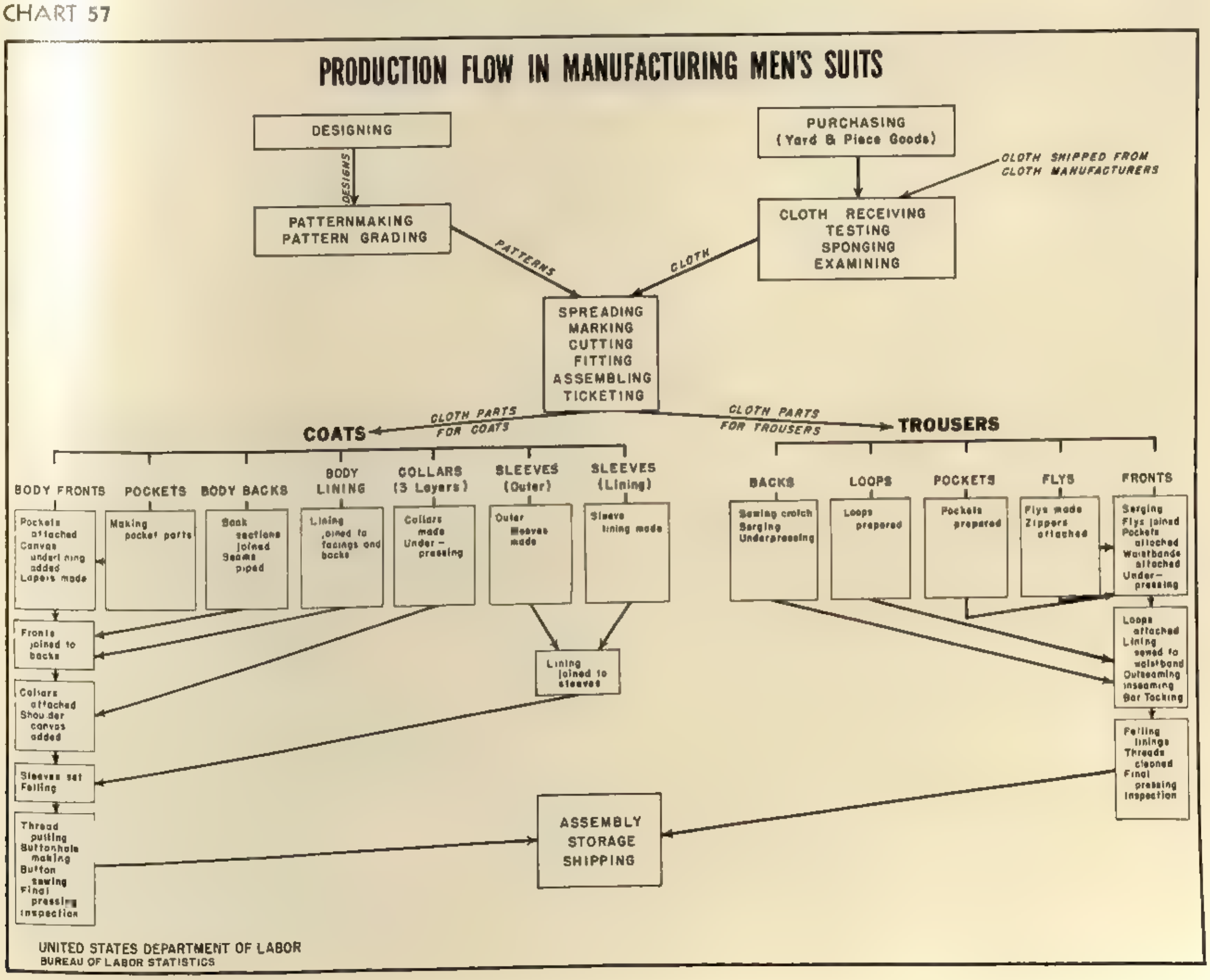
ture of pants or linings, or the sponging and shrinking processes, while other plants are completely integrated and perform all the operations involved in the manufacture of a garment.

The manufacturing process varies primarily with the quality of the garments produced. Practically all firms making readymade clothing are graded from 1 to 6, according to the amount of handwork, the quality of the work, and the supervision of the operations being performed. These grades are established by agreements between the Amalgamated Clothing Workers of America and the industry's employers. The higher grade garments involve more hand sewing, pressing, and inspection than the lower grades. Grade 1 suits, for example, are almost entirely machine made, with a minimum of handwork. On the other hand, grade 6 suits have a great amount of hand sewing and pressing. A plant ordinarily produces only a certain grade of garment and generally do not convert to manufacturing clothing of another grade.

Despite these variations, there is a typical manufacturing process which can be described in general terms for a large plant. The following description of procedures followed in manufacturing men's clothing is given as an aid in understanding the kinds of jobs found in this industry. (See chart 57.) The manufacturing process begins with the designer who designs a suit and has a sample garment made. If the sample meets the approval of the company's executives, a pattern is made by a patternmaker. This master pattern is then made into patterns of various sizes by pattern graders and the completed patterns are sent to the cutting room.

Meanwhile, the purchasing department has bought the fabric and trimmings, and samples have been tested in the laboratory. After the cloth has been examined and measured, it is sent

CHART 57



to the sponging room where it is preshrunk so it will not change shape or texture after the garment is made. The fabric is then dried, finished, and folded or rolled. Small firms often contract these operations to specialized firms.

The first step in the actual fabrication of a garment takes place in the cutting department. The cloth is stretched out on long cutting tables in several layers or "plies"—the number of plies depending upon the quality and number of garments being made. Using the patterns made by the pattern grader as guides, a cutter marks and cuts the cloth. Although cutting is done primarily with machines, in higher grade plants, some suit and topcoat fabrics are often cut by hand. The cloth cuttings are then prepared for sewing by fitters who do such jobs as marking locations for pockets, buttons, buttonholes, and belt loops. The garment pieces are then sorted into bundles, with identifying tickets attached, and routed to the various sections of the sewing department where the garment is to be assembled.

Most plants use the bundle system in which the cut pieces are moved through the sewing department in bundles of from 5 to 60 or more pieces. The bundle of cuttings constitutes the unit of work until the final assembly of the garments. Coats and pants are usually assembled in separate departments. The garment begins to take form as it passes through a succession of highly specialized sewing and pressing operations.

Each worker is assigned a specific sewing or pressing task in the assembly process. Some baste linings, join pieces together, or sew tapes around parts which must hold their shape. Some sewers work by hand; and others use a variety of high-speed machines which also cut holes, turn corners, trim edges, and add tapes.

From time to time during these operations, the seams are pressed so that parts will retain their shape and a better fitting garment can be produced. At various stages of production, the garment is inspected for proper workmanship. A final check is often made by a journeyman tailor before the finished garment leaves the plant.

Men's Tailored Clothing Industry Occupations

The men's tailored clothing industry employs persons who can learn their jobs after a few weeks of training, as well as persons who need several years of experience and training before they can perform their jobs efficiently. About 90 percent of the workers in this industry are production (plant) workers. This industry's proportion of production workers is one of the highest among manufacturing industries. The largest group of plant workers are in hand- or machine-sewing jobs. Other large numbers of plant workers are employed in pressing and cutting room jobs. Some of the important occupations in the industry are described below.

Designing, Patternmaking, and Pattern Grading Occupations

The *designer* (D. O. T. 0–46.01) originates new style ideas. He prepares rough sketches to illustrate these ideas and submits them to the management for approval. The approved designs are then developed into finished sketches for use by the patternmaker in constructing a master pattern. Since designing is a creative job, designers are left to their own initiative as long as they produce results. A large clothing manufacturer usually has 1 designer and 1 or more assistant designers who often have specialized design responsibilities of their own. Most small plants do not employ designers but purchase ready-made designs.

Patternmakers (D. O. T. 4–27.432) draw, and cut out a full-sized master pattern for each garment model. The patternmaker works closely with the designer and translates the sketch or model furnished by the designer into the paper or fiberboard pattern pieces. These pieces are used as the patterns from which the finished garment is cut. In making the pattern pieces, the patternmaker must take into account allowances for pleats, yokes, sewing, or shrinkage. The master pattern is then sent to the pattern graders. In some shops, designers or journeyman tailors may make the patterns, whereas in other shops, the assistant designer performs the patternmaking tasks.

Pattern graders (D. O. T. 4–27.431) use the master pattern as a model to make patterns for each size. In a sense, a pattern grader is a specialized draftsman who makes the pattern conform to a variety of human figures. His work requires a detailed knowledge of the garments manufactured by his concern as well as a thorough knowledge of standard garments and proportions. Proportion tables of the human body,

worked out from years of experience, are used to guide the pattern grader. The completed fiberboard patterns made by the pattern grader are sent to the cutting room, where they are used as guides in cutting out the pieces of cloth for the garments.

Cutting Room Occupations

The job of the workers in the cutting room is to spread and mark the cloth and cut the pieces needed for the fabrication of the garment. The bolts of cloth are first spread out on a cutting table by *spreaders* (D. O. T. 6–27.015, .016) in multiple layers before marking and cutting. In some plants, spreaders use manually operated machines, while in other plants they may spread the cloth completely by hand. They must lay out the cloth so that defects, which have been previously noted in the cloth, are not included in the parts to be cut out for garments.

Markers (D. O. T. 4–27.011) lay out the patterns of the various garment parts on top of the layers of cloth and then trace the outlines with chalk. The marker lays the patterns close together to avoid wasting cloth, but still leaves space for the cutter to operate. Figured cloth must be marked so that adjoining garment parts will match when the garment is assembled. In small shops, the marker may also perform the duties of the spreader.

The job of the *cutter* (D. O. T. 6–27.054) is to cut out the various parts of the garment from the marked layers of cloth which are spread on the tables. The cutter follows the pattern outline with an automatic cutting tool or hand shears. Cutters must be very accurate because errors in cutting may result in considerable loss of cloth and may alter the final dimensions of the garments. In smaller shops, a cutter may do spreading and marking as well as cutting.

Marker tracing the outlines of the various patterns on the top layer of a cloth pile.

Cutters using machines to cut the garment parts from marked plies of cloth.

Fitters or trimmers (D. O. T. 6–27.044) are specialized cutting room workers who sort, match, and trim small garment parts, linings, and tapes. In addition, they prepare cutout garment parts for sewing by marking locations for pockets, buttons, buttonholes, and belt loops.

Sewing Room Occupations

More than half the workers in clothing plants are engaged in some type of machine or hand sewing job. Sewers join the cuttings to make parts, such as sleeves, shoulders, and backs, and assemble these parts into the finished garment. Workers usually specialize in performing a single operation or group of operations.

About 40 percent of the workers in the men's tailored clothing industry are engaged in machine-sewing jobs. The *sewing-machine operators* (D. O. T. 6–27.530, .539) comprise the largest single group of workers in the industry. Sewing-machine operators use several types of standard, all purpose machines similar to those found in the home or special heavy duty machines designed to perform a single operation at high speed. Special devices or attachments such as button-holding clamps, seam-folding attachments, and stitch-guiding devices, are used to facilitate the sewing operations.

Some workers specialize in a single operation, such as attaching collars and cuffs, joining fronts and backs of a garment, or sewing armholes; others make complete collars, cuffs, or pockets. All-round operators or "switchers," who are experienced in using many different machines, are used to replace absent or ill workers, or to assist sections behind in production.

Among the more important sewing machine operator jobs are machine basters, who put in the long loose stitches which hold garments together until permanently stitched; joiners, who bring together the various garment parts; and lapel padders, who stitch padding into lapels.

Hand sewer basting shoulder squares.

Some hand sewing is used in all grades of suits and coats, but most *hand sewers* (D. O. T. 6–27.071, .082) are employed in the plants producing the higher grade garments. The amount of handwork determines the quality of the garment and many of the operations performed by machine in making lower grade garments are done by hand in the production of higher grade garments. The hand sewers use needles and threads of various sizes to perform operations ranging from simple basting to the more complex stitching. Most hand sewers specialize in a single operation, such as basting, buttonhole making, and finishing.

Tailoring Occupations

Tailors (D. O. T. 4–26.101, .201) are skilled hand sewers able to perform all or most of the sewing operations needed to fabricate a garment. There are at least four classifications of tailors recognized in the industry. These are: head tailors, bushelmen, shop tailors, and journeymen tailors.

Head tailors are often known as "quality men," since they are responsible for the quality of the firm's output. They supervise the machine sewers to make certain that shop standards are met, and to insure that garment parts having imperfections are returned to the operator for correction.

Bushelmen repair the manufacturing defects found in the completed garments by the final inspector. They cut loose stitches, trim inaccurately sewed parts, rearrange the padding, and do other necessary corrective sewing.

Shop tailors perform specialized tasks, such as fitting collar facing to the coat, basting the collar to the coat, stitching shoulder padding, or sewing canvas in the various coat parts. Their occupational titles are generally determined by the type of work they do. Thus, they may be called coat basters, lapel padders, or collar setters. Although some shop tailors, through training and experience, may be able to do all-round tailoring, their work, like the work of machine or hand sewers, is generally limited to 1 or 2 specific sewing operations.

Most journeymen tailors are employed in custom tailoring shops and the few employed in

clothing plants are occupied mostly in constructing sample garments for the designing department. Journeymen tailors make complete tailored garments from the initial design to the final sewing, or perform the more difficult hand and machine work. The journeyman tailor measures the customer for size, designs the garment, and prepares the pattern, using the customer's measurements. He then marks out the pattern, cuts the cloth, assembles and bastes the cut parts, and sews the garment together.

Pressing Occupations

Pressing is one of the most important processes in the manufacture of men's clothing, since the shape and appearance of the finished garment are determined to a great extent by the quality and amount of pressing. Approximately 1 out of 6 clothing workers is employed in a pressing job and more than 90 percent of these jobs are held by men. *Pressers* (D. O. T. 7-57.501, .511) use various types of steam pressing machines or hand

Finish pressing a suit coat with hand iron. Finish pressers are among the highest paid of men's clothing workers.

irons to flatten seams or to give the required shape to the garment part or finished garment.

There are two basic types of pressers—underpressers who shape and smooth parts during manufacture, and finish pressers who press and smooth a finished part or a completed garment. Underpressers specialize in working on particular garment parts such as armholes, seams, shoulders, or linings. Their duties vary from simple smoothing of cloth and flattening of seams to the skillful shaping of garment parts. Many of the operations are performed on a steam pressing machine similar to those found in a valet shop. As in underpressing, finish pressers use steam pressing machines and hand irons.

Other Plant Occupations

Many other workers have specialized jobs in the manufacturing process. For example, shapers trim and cut various parts of partially completed garments with shears, to shape them accurately and to make them conform to the original pattern. Assemblers gather the cut garment pieces into bundles. They match parts according to color or style. Ticketers attach identifying tickets to the garment parts before they are sent to the sewing sections. Work distributors assign bundles of garment parts to various sections during the work process. Thread trimmers or cleaners remove loose threads and basting, and brush thread and dirt from the garments to prepare them for final pressing. Inspectors determine whether the garments conform to shop standards and, in some cases, perform minor repairs.

Administrative and Clerical Occupations

The majority of administrative positions are in the production department. The production manager and his assistants are responsible for planning production schedules, issuing work specifications, and supervising the preparation of raw materials and their fabrication into finished garments.

Clerks, bookkeepers, stenographers, and other office workers are employed to keep records and attend to the paper work required in this industry. The men's clothing industry also employs credit managers, accountants, comptrollers, salesmen, and industrial relations personnel, such as are found in other industries.

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Training, Other Qualifications, and Advancement

In general, the physical requirements for production jobs in this industry are not high, but good eyesight and manual dexterity are essential. Many of the occupations in this industry are particularly suitable for handicapped workers, since the majority of jobs are performed while seated and little physical exertion is required. Neither age nor sex is a barrier to employment in this industry. Few manufacturing industries have as high a proportion of older workers as the men's tailored clothing industry. Older workers in their fifties or sixties are among the most skilled and productive workers found in many plants. Women are employed in most occupations, although cutting, pressing, and tailoring jobs are predominantly held by men.

Most plant workers in this industry pick up their skills while working as helpers to experienced craftsmen. The training time required before a new employee in a production job can reach his maximum earning speed depends upon the difficulty of the task and the worker's aptitude. Apprenticeship is rare and limited to cutting and tailoring craft jobs. The following is a brief discussion of the training, qualifications, and advancement opportunities for selected plant occupations.

Designing, Patternmaking, and Pattern Grading Occupations

The small number of designers now in this occupation entered their jobs in various ways. Some designers were upgraded from cutting or patternmaking jobs. Other designers attended schools, such as the Fashion Institute of Technology in New York City, which specialize in training people for designing occupations. Regardless of method of entry, designers generally first serve several years as assistant designers. Designers often start with small firms and, once their reputations have been established, transfer to jobs in larger, better paying firms.

A designer must have a thorough knowledge of materials and be acquainted with garmentmaking techniques so that he can make, or direct others in the making of, sample garments. A talent for design sketching and the ability to translate fashion ideas into specific patterns are important qualifications for designers.

Most patternmakers pick up the skills of their trade by working for several years as helpers to journeymen patternmakers. Pattern graders and cutters are occasionally promoted to patternmaking jobs. Patternmaking requires a detailed knowledge of manufacturing processes, as well as a knowledge of body proportions and the characteristics of fabrics. Another qualification for this work is the ability to visualize, from a sketch or model furnished by the designer, the size, shape, and number of pattern pieces.

Pattern graders are usually selected from employees working in the cutting room or other plant jobs. Training in drafting is helpful, since much of the work requires the use of drafting tools or techniques.

Cutting Room Occupations

Most workers enter cutting room jobs by being promoted from other departments. One of the few definite promotional patterns in the industry is found in the cutting department. The usual path of promotion is from spreader, the least skilled job, to cutter or marker. Several years of experience in the cutting room are required before an employee can become a skilled cutter or marker. A small number of the larger plants have apprenticeship programs. The apprenticeship program usually lasts 4 years and includes all-round training in cutting, marking, spreading, and patternmaking.

Markers must be able to visualize pattern arrangements to get the maximum number of cuttings from a given quantity of cloth. Cutters must be able to judge distances accurately and have steady hands in order to follow marked lines precisely.

Sewing Room Occupations

Entry into beginning hand- or machine-sewing jobs is relatively easy, since little education is required, and there are few restrictions regarding physical conditions or age. Usually, some previous training is preferred, although some concerns will hire workers with only home handicraft experience. A number of private and public schools in clothing manufacturing centers offer instruction in machine and hand sewing, and some workers are hired after such training. However, most training is informal and received on the job under supervision of the section foreman or coworkers.

A few firms have special training programs in which new workers receive preliminary training before being placed on a production line.

Most sewing jobs require the ability to do painstaking, routine work rapidly. The same sewing operation is repeated on the same garment part. Since almost all of these workers are paid on the basis of number of pieces produced, any handicap or clumsiness of the fingers, hands, and arms will reduce the worker's earnings. Good eyesight and ability to work at a steady and fast pace are essential for both hand and machine sewing.

The average sewer has little opportunity for promotion beyond that of section foreman, although in some cases, sewers have worked their way up to production managers. Most sewers stay on the same operation through most of their working life. Sewers are reluctant to change their sewing specialty, since this causes a loss in earnings during the retraining period. However, it is possible for a worker to transfer to a clothing plant making garments one grade below or above the grade on which he was trained without seriously impairing his earnings, provided he performs the same sewing speciality.

Tailoring Occupations

Although some tailors entered the trade through apprenticeship programs, most of these workers became tailors after acquiring experience in the less skilled sewing jobs. The skills of the trade are usually learned by working alongside experienced tailors. Training time varies from the few months required to become a shop tailor to the many years of experience necessary to become a head tailor. Generally, men are employed in tailoring jobs.

Head tailors and journeymen tailors must be able to do all the operations involved in constructing a garment and, in addition, be familiar with their firm's quality standards. Since the work of the bushelmen is restricted to correction of defects, they do not require the broad training of the journeymen tailors.

In terms of the skill and experience required, head tailoring is considered the top tailoring job. The possible paths of promotions are from bushelman to journeyman tailor to head tailor. In some cases, journeymen tailors may be advanced to the designing department. The supervisory jobs in clothing plants are often filled by workers who were originally trained as journeymen tailors. Promotion for shop tailors is limited because of the specialized nature of their jobs, although some may have an opportunity to become section foremen or bushelmen.

Pressing Occupations

Pressers usually begin as underpressers working on simple seams and single garment parts. After they gain experience they work on more difficult jobs and eventually may be promoted to finish pressers. Pressing is one of the few clothing occupations in which workers can find similar jobs outside the industry, and there is some transferring back and forth between jobs in the clothing industry and outside jobs. Simple underpressing may be learned in a very short time, although high rates of production may be reached only after several months of experience.

Employment Outlook

Little change in the level of employment in the men's tailored clothing industry is expected in the 1956–66 decade. However, a large proportion of the people in this industy are older workers—more than half of them are over 50 years of age. Many job openings, therefore, will result from the need to replace those workers who die or retire in the late 1950's and the 1960's. Another factor which will contribute to future job openings is the large proportion of women in the industry, many of whom may leave their jobs to marry or raise families.

Despite the growing population and rising income level of the last 20 years, the output of men's tailored clothing has not risen in the same proportion. On the average, American men and boys have been purchasing fewer suits, topcoats, and overcoats in recent years. They have substituted, for the more formal clothing, sport clothes and cotton garments as a result of increased leisure time and the trend toward casual, suburban living.

Since 1948, the number of topcoats and overcoats produced has markedly declined, the number of tailored suits has stayed about the same, and the production of slacks and sportcoats has increased greatly. This shift to slacks (separate trousers) and sportcoats has been an important factor in reducing employment because less labor time is required for their manufacture. (However, it should be noted that most slacks are pro-

duced in plants not classified in this industry and their employees are not included in the employment figures for the men's tailored clothing industry.)

Another important factor which has affected demand has been the intense competition for the consumer's dollar by other industries. Studies of consumer spending habits indicate that during recent years a declining proportion of disposable income was being spent on men's clothing, and the proportion spent on consumer durable goods, such as automobiles, television sets, radios, and similar goods, was steadily increasing.

The men's clothing industry, largely as a result of this declining demand, has not participated in the great expansion of employment which has occurred since the beginning of World War II. Since the postwar high of 153,000 in 1948, the number of workers in this industry has declined to less than 122,000 in 1956.

Technological developments have also been a factor in this employment decline. Despite the fact that most of the work performed is done by hand, improvements in factory layout, further specialization of labor, and new machinery have resulted in increases in output per man-hour. Since 1948, the number of garments produced per employee has been steadily increasing.

There are some factors which may, in the future, reverse the trend of declining employment. The heavy birthrate of the war and postwar years should increase the demand for men's tailored clothing in the 1960's, when the largest group of male youths in the history of the country will be reaching adult age. Furthermore, both management and labor are taking active steps to promote the sale of the industry's products by making men more style conscious. But after taking into consideration all the various factors affecting employment in this industry, little change in total employment is expected in the 1956–66 decade.

Employment opportunities will differ among the occupations in this industry. Most opportunities for employment will be in hand- and machine-sewing jobs because this is the largest occupational group. Young Americans have not entered hand sewing jobs in any large number, and employers in some garment centers have been forced to bring in workers from foreign countries to fill openings. Since most of the workers in machine-sewing jobs are women, numerous openings should occur to replace the women who will leave the labor force after working temporarily to supplement the family income.

There will be a limited number of opportunities for new workers to obtain designing, patternmaking, and cutting room jobs. These are small occupational fields with little turnover because of the high pay and status enjoyed by workers in these jobs.

The nature of jobs in the industry is not expected to change radically. This is primarily a handwork industry and is not susceptible to automation or drastic mechanical advances. However, new and improved machinery should speed operations and reduce the physical and skill requirements of some jobs. For example, new compressed air pressing machines which require less physical effort than the older pressing machines may make it possible to utilize women in these jobs. In addition, the shortage of skilled handworkers is forcing some manufacturers to substitute machine work for hand operations.

Earnings and Working Conditions

Earnings in the men's and boys' tailored clothing industry are generally not as high as the average earnings in all manufacturing industries. Production workers in the men's clothing industry were earning, on the average, $64.78 a week or $1.77 an hour in December 1956. During the same month, production workers in all manufacturing industries averaged $84.05 a week and $2.05 an hour.

Earnings in this industry vary, depending upon the job being performed, the location of the job, and the speed and ability of the individual worker. With the exception of designing and cutting room jobs, the majority of the workers are paid by the piece produced. Thus, total earnings in piece-rate jobs are dependent upon speed as well as skill. Although recent occupational earnings data for the industry are not available on a national scale, wage information from a few selected manufacturers in metropolitan clothing centers gives some indication of the earnings of workers in selected occupations.

The average earnings of designers are far above those of the industry as a whole. The unique artistic talents of designers enable them to command higher earnings than the other workers in this industry. Designers employed by some large manufacturers earn in excess of $15,000 a year.

The skilled workers in the cutting room are paid on an hourly basis. In mid-1956, cutters and workers were generally earning about $100 a week in most large garment centers. Spreaders usually earn somewhat less than cutters. Head tailors are paid weekly wages which are based primarily upon the responsibilities of their job and many head tailors were earning more than $100 a week. Other tailors and basters were generally earning $2 an hour in some of the major garment centers.

Earnings among hand sewers and sewing-machine operators vary widely—principally because of differences of skill requirements and the speed of individual workers. Earnings data obtained in 1956 from a number of employers in large garment centers indicated that machine sewers were generally earning from $1.60 to $2.60 an hour and hand sewers, from $1.40 to $2 an hour.

Earnings for finish pressers generally ranged from about $1.80 to $2.90 an hour. Underpressers in many garment centers earned less than finish pressers.

More than 95 percent of the plant workers in this industry are members of the Amalgamated Clothing Workers of America. The union shop agreement prevails in the industry, and new employees in shops which have union shop agreements are required to join the union after 30 days of employment. Workers in this industry have many supplemental benefits including vacations with pay; life, accident, and health insurance; maternity and death benefits; and hospital and pension plans. Workers in the industry can expect to lose very little time from strikes or other work stoppages. The men's tailored clothing industry is noted for its many years of industrial peace.

Although seasonality of employment has been greatly reduced in recent years, employment in this industry still fluctuates more than in many other manufacturing industries. Highest employment is reached in February, March, August, and September when the industry is producing clothing for the spring and fall wholesale and retail markets. Employment is usually at its lowest in April, May, June, and July.

Clothing manufacturing is essentially a clean trade without the dust or grease present in many manufacturing establishments. Working conditions vary considerably, depending upon the type of plant and occupation. The large, integrated manufacturers are usually located in modern factory buildings with ample work space and good lighting, but many of the smaller companies are located in older buildings where working conditions are not as attractive. As in other piece-rate industries where earnings depend upon speed, the working pace is rapid.

Disabling injuries are not frequent in this industry. The injury-frequency rate for each million employee-hours worked in the second quarter of 1956 was 6.3, compared with 11.9 for all manufacturing industries. Pressers are subject to occasional burns, and their jobs require heavy physical exertion. Needle punctures and minor hand injuries are the most frequent occupational hazards in most of the other clothing occupations.

Where To Go for More Information

Further information on occupations in the men's tailored clothing industry may be obtained from the following sources:

Amalgamated Clothing Workers of America,
15 Union Square, New York 3, N. Y.

Clothing Manufacturers Association of America,
220 Fifth Ave., New York 1, N. Y.

PETROLEUM PRODUCTION AND REFINING OCCUPATIONS

The Petroleum Industry and Its Workers

The products produced by the petroleum industry play a vital part in our everyday life. From this industry come the gasoline used by millions of cars and trucks and great fleets of military and civilian aircraft; the oil that heats several million homes and provides power for thousands of locomotives and ships; the lubricants without which modern machinery could not be operated; the asphalt covering used on thousands of miles of highways; and hundreds of other products ranging from insecticides to plastic materials.

The petroleum industry is an important field of employment. Petroleum production and refining, the segments of the industry covered in this report, employed over one-half million wage and salary workers in 1956. Production and refining offer job opportunities to workers with a wide range of skills and interests. Earnings in these segments of the petroleum industry are high and jobs are located in many different parts of the country.

Nature and Location of the Industry

There are thousands of companies in the oil business, most of them engaged in a single specialized activity such as exploring, drilling wells, producing or transporting oil, or operating service stations. The bulk of the oil business, however, is done by a limited number of large firms engaged in all branches, from production through marketing. These "integrated" firms provide a large share of the jobs in the industry.

This chapter deals exclusively with petroleum production and refining. It contains no discussion of the workers engaged in the production of natural gas or natural gasoline which is often associated with crude oil production. Because current employment data are not available for workers engaged only in crude petroleum production, the figures given in this chapter include workers engaged in both crude petroleum and natural gas production. However, the large majority of these workers are engaged in petroleum production.

Petroleum Production

In 1956, more than 330,000 wage and salary workers were employed in petroleum and natural gas production in the United States. Although oil is produced in 29 States, more than 85 percent of the workers are employed in 9 States: Texas, Oklahoma, Louisiana, California, Kansas, Illinois, New Mexico, Wyoming, and Pennsylvania. As chart 58 indicates, Texas is the leading State in the number of oilfield jobs. Several thousand Americans are also employed by oil companies or independent contractors in practically all producing countries. Many jobs abroad are concentrated in the Middle East, particularly in Saudi Arabia. Many Americans are also working in Venezuela and other South American countries and in Canada.

Crude oil is the raw material of the petroleum industry. The jobs and processes in the petroleum production branch of the industry are concerned with the problems of finding the crude oil and extracting it from the ground. Petroleum production includes three broad kinds of work: exploration, drilling and oilfield servicing, and well operation and maintenance (production).

Exploration. Since oil is difficult to find—only rarely are there any signs on the earth's surface of its presence underground—a sizable business has grown up having to do with the application of scientific methods to the search for oil. This work is performed by the exploration departments of major oil companies. Some independent firms are also engaged in exploration, working under contract to companies or individuals seeking appropriate places to drill for oil. Approximately 15 percent of petroleum production workers are engaged in exploration.

The various exploration methods can neither show the precise location of oil nor indicate with certainty whether petroleum is present at a particular place. What they can do is to locate geological formations and conditions favorable to oil accumulation.

Drilling, Rig Building, and Other Oilfield Servicing. More than 57,000 wells were drilled in the United States in 1956. Approximately 35 percent of the employees in petroleum production are engaged in this work. Oil producing companies do some drilling, but most is done by independent firms working under contract. In 1956 Texas was the leading State both in number of wells and total footage drilled. Oklahoma, Kansas, Louisiana, Illinois, California, Colorado, and New Mexico were the other leading States.

Before a well can be drilled, a derrick, upon which the machinery and drilling equipment are fastened, usually is built on the spot where the drilling equipment is to be placed and the drilling is to be done. In some wells a portable rig which has been already assembled is used. A number of independent contracting companies specialize in rig and derrick building, repairing, and dismantling.

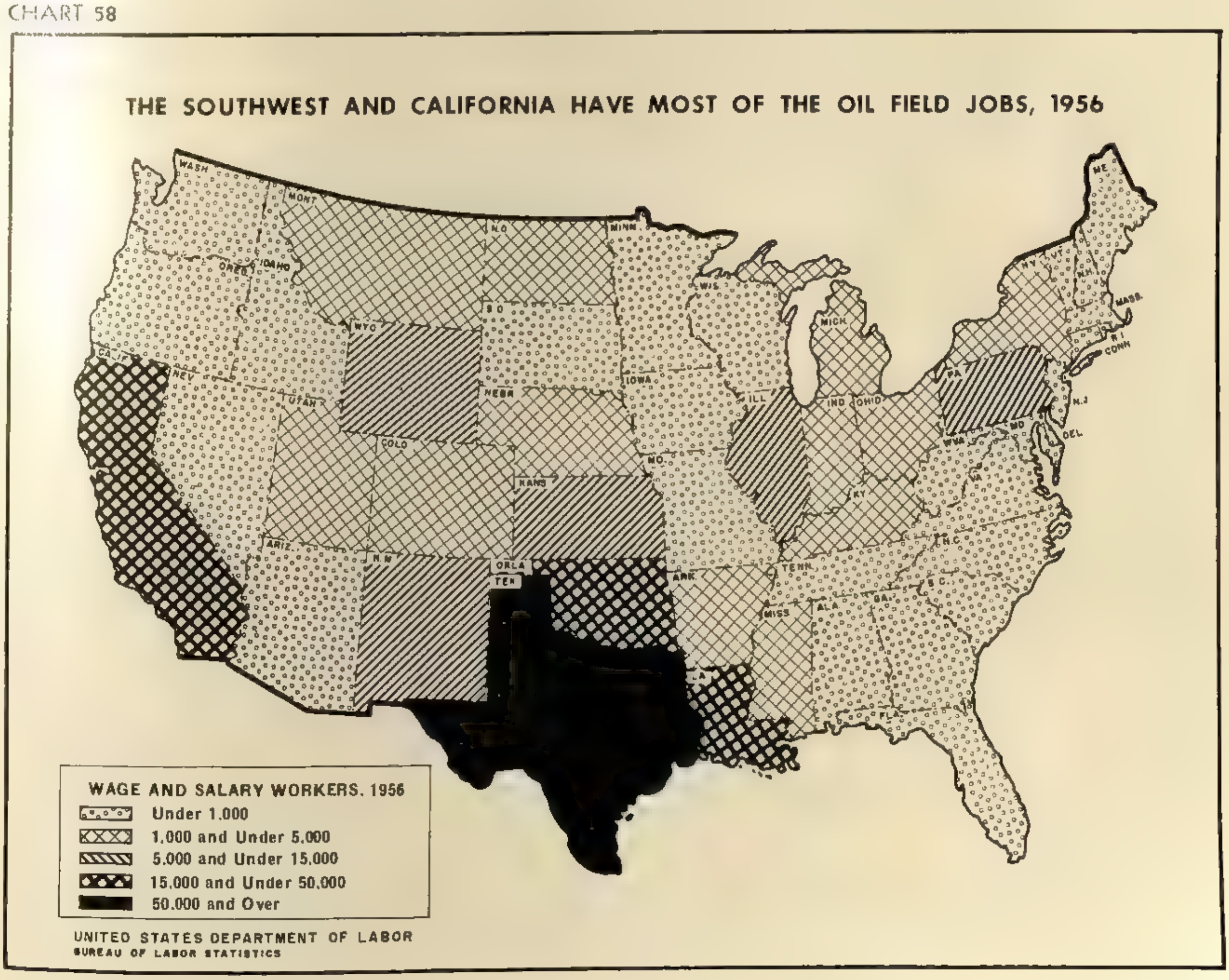
Besides drilling and rig building, a number of other necessary services are performed in connection with oil production. These services include hauling supplies, cementing wells, chemical treatment in cleaning of wells, and other special operations. Most of this work is handled by independent contractors.

Crude Petroleum Production. Once oil is found, the next job is to bring it out of the ground. More than half of the oilfield workers are engaged in operating or maintaining the more than half million producing wells. Thousands of companies operate oil wells; they range in size from some of the largest concerns in the world to small firms with only a single well.

Petroleum Refining

Crude oil as it comes from the ground has few uses. It must be taken apart and built up or

CHART 58



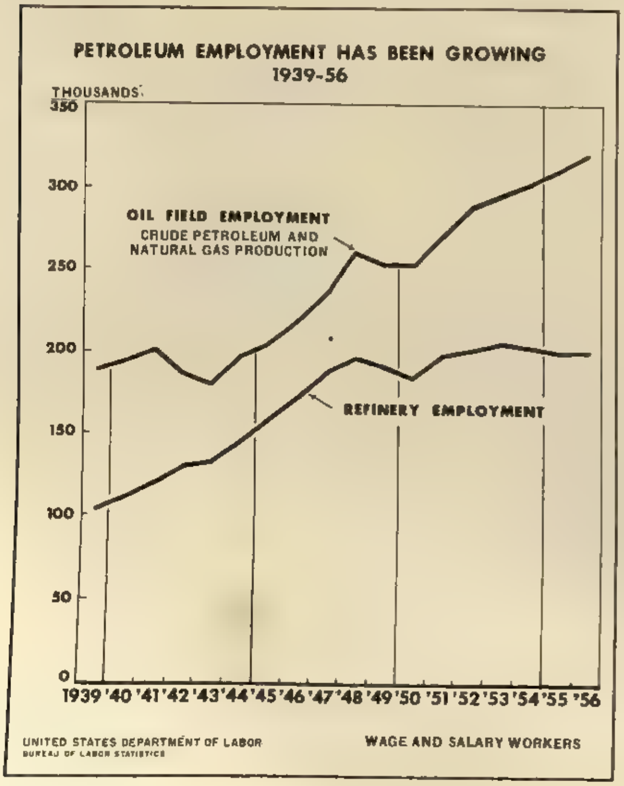
broken down by heat, chemicals, and pressures to make useful end products, such as gasoline, fuel oil, kerosene, and lubricants. This processing is called refining and is done in plants called refineries.

The more than 300 refineries in operation in the country in 1956 employed more than 200,000 wage and salary workers. (See chart 59.) Refineries range in size from small plants with fewer than 50 employees to plants with several thousand employees. They are usually located in the great oil-consuming or producing areas—near oilfields, at the terminals of oil pipelines, or at deepwater ports where tankers can dock. Refineries are located in 39 States but about 90 percent of the refinery workers are employed in 10 States: Texas, California, Pennsylvania, Louisiana, New Jersey, Indiana, Illinois, New York, Oklahoma, and Ohio. Texas, California, and Pennsylvania together accounted for about half of the total oil refining employment in 1956. Many Americans are employed in refinery jobs abroad.

Employment Outlook

The growing demand for petroleum products is expected to result in an increase in employment

CHART 59



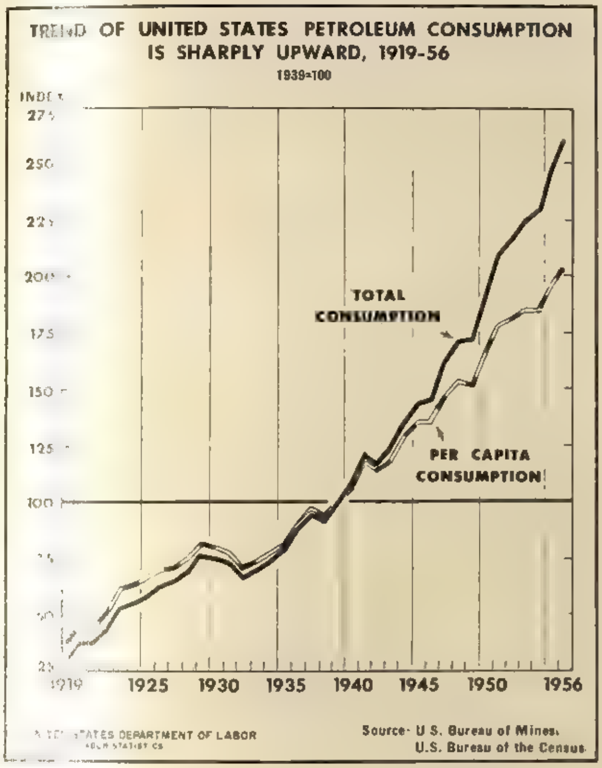
in both petroleum production and refining in the late 1950's and the 1960's. Employment in petroleum production may be affected, however, by the increasing difficulty of finding oil and the increased cost of drilling and exploration activities. If these factors bring about an increased dependence on imports of crude petroleum they may slow the growth of employment in this branch of the industry. Petroleum refining, on the other hand, would not be affected by crude oil imports since this oil would be refined in this country. Employment in petroleum refineries, however, is not expected to increase nearly as much as the consumption of petroleum products. Technological developments in the refining processes are increasing output per worker. (See pp. 542, 546 for a more complete discussion of the employment outlook in petroleum production and refining.)

Many factors affect the long-range outlook for employment in the petroleum industry. Some of them are reasonably predictable, such as the generally rising trend in demand for petroleum products. Others are fundamentally uncertain. No one can say, for example, exactly how much oil remains underground, where it is, or how long it will be before it is discovered. Another imponderable, in the long run, is the rate at which alternate sources of energy may be developed. The future is uncertain in another respect. The petroleum industry is worldwide and its products are not only essential in the normal operation of our industrial society, but also have critical military importance. Unpredictable military and diplomatic factors, therefore, may greatly affect the outlook. Nevertheless, observable trends can be used in evaluating future job opportunities, subject to the qualifications which we have noted.

Demand for Petroleum Products

The long-range trend in demand for petroleum products has been sharply upward. Since 1929 the consumption of petroleum products has more than tripled. (See chart 60.) Many factors have contributed to this growth. Probably the most important single element has been the rapid increase in the number of motor vehicles. In 1900, for example, about 4,000 automobiles were registered in the United States; in 1956 more than 65 million cars and trucks were in use. The growth of other forms of transportation also increased the demand for petroleum products. The numbers

CHART 60



of farm tractors and airplanes have sharply increased. Several million homes and other buildings are now being heated by distillate oils and oil has become important as a source of energy for industrial power generation. Petroleum has also become an important raw material for the chemical industry.

All indications point to a continued and fairly rapid rise in demand during the late 1950's and the 1960's. Most of the factors responsible for past growth are expected to continue to influence further growth.

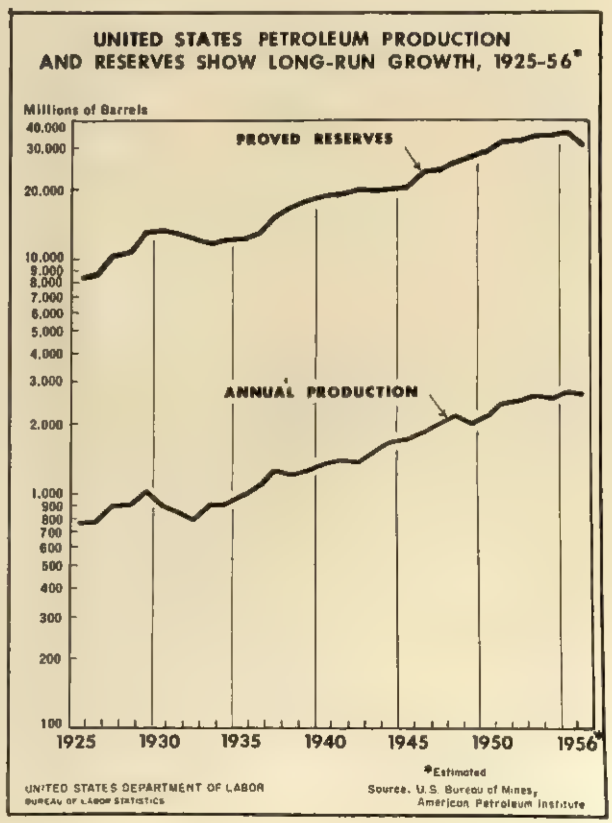
It is necessary to consider possible competitive sources of energy and technological developments which might affect the demand for petroleum products. These include the commercial production of liquid fuels from oil, shale, and coal, and the industrial use of atomic energy. A development which may affect oil consumption is the commercial application of the gas turbine or the free piston engine which would require different types and amounts of fuel from those consumed by present-day motor vehicles. However, indications are that at least for the next decade these developments will not significantly affect the demand for petroleum products.

The Supply of Crude Oil

All evidence indicates that the supply of oil is adequate to meet expected demand for the foreseeable future. Chart 61 shows trends in United States petroleum proved reserves and production (the estimated amount of oil known to be underground and recoverable by present methods). The trend in reserves is clearly upward and there have been relatively few years in which reserves were not greater than those in preceding years. The relationship between proved reserves and production has remained fairly stable in the past 30 years—about 12 or 13 times annual production. In addition to proved reserves, many billions of barrels are believed to be present underground but as yet undiscovered.

Our oil supplies are being stretched by improved recovery and conservation methods. In recent years, the rate at which oil is withdrawn from the ground has been controlled by State action or by voluntary agreements of petroleum producers, thereby increasing the ultimate amount of oil recoverable from each pool. Where formerly as much as two-thirds of the oil was left in the

CHART 61



ground, now new methods have been developed whereby as much as 80 percent of the oil is recoverable.

Although our domestic proved reserves have been rising, they have been growing at a declining rate and oil is getting harder to find. However, since the petroleum industry is worldwide in scope, it is necessary also to take into account the estimates of oil supply abroad. Crude reserves in the Western Hemisphere outside the United States are estimated at about 18 billion barrels; most of it in Venezuela. In the Eastern Hemisphere, mainly in the Middle East, proved reserves amount to about 131 billion barrels. Proved reserves of the entire world were estimated at 189 billion barrels in 1956. Therefore, if the United States has access to this crude petroleum, supply should be adequate to meet demand for many years and the industry should be able to maintain a high and rising level of employment.

Where To Go for More Information

Further information concerning jobs, processes, and working conditions in the petroleum industry can be obtained from:

American Petroleum Institute, Department of Information, 50 West 50th St., New York 20, N. Y.

Petroleum Production Occupations

Nature of Work

Petroleum production includes three broad kinds of work: exploration, drilling, and well operation and maintenance. Except for some scientific and supervisory jobs, there is little transferability of skills among these activities.

Exploration

Exploration is concerned with finding underground geologic structures likely to contain oil. Two main methods of exploration are used—geological and geophysical. The geological method explores the surface and subsurface of the earth and the geophysical studies the inner characteristics of the earth's structure. The methods may often be combined.

Geological parties headed by a *petroleum geologist* (D. O. T. 0–35.63) study and map surface and subsurface rock structures. The "rock hound," as the geologist is sometimes called, seeks clues to the possibility of oil traps by the type of rocks and rock formation and the presence of fossils. Besides making detailed, foot-by-foot field surveys, petroleum geologists also depend upon aerial photographs for clues as to the location of petroleum deposits. Frequently, "core drill" samples are taken from below the earth's surface to be examined by the geologist for indications of oil sources.

The main function of petroleum geologists is to recommend where to drill for oil. They also advise management on methods of drilling and oil-field development. They may make appraisals of properties for leasing, and estimate oil reserves. Many geologists work in the central district office of oil companies or exploration firms. Some of them, however, spend a great deal of their time making field surveys in rough and isolated sections of the country.

Geological parties may include, in addition to the geologist, *paleontologists* (D. O. T. 0–36.03), who study the fossil remains in rocks in order to determine the geological age, *chemists* (D. O. T. 0–07.80) and *mineralogists* (D. O. T. 0–35.63), who analyze rock samples. *Plane-table operators* (D. O. T. 0–64.30), *draftsmen* (D. O. T. 0–48.50), and *rodmen* (D. O. T. 7–87.100) assist in surveying and mapping operations. A *shallow drilling crew* may also be part of the party.

More than 90 percent of geophysical exploration is done by seismic prospecting. A dynamite charge causes a small earthquake. The rate of transmission of sound waves through the earth is then measured, recorded, and interpreted by geophysicists. The readings are used to determine the nature of deep underground formations which may indicate an oil pool.

A seismograph crew generally consists of from 10 to 18 persons working under the supervision of a party chief, who is usually a college-trained *geophysicist* (D. O. T. 0–35.65). *Computers* (D. O. T. 0–66.67) prepare maps from the seismic data. *Observers* (D. O. T. 0–66.66), who are often electrical engineers, operate and maintain the seismic equipment. *Prospecting drillers* (D. O. T. 5–75.050) and their *helpers* (D. O. T. 7–75.050)

operate portable drilling rigs to make holes into which explosive charges are placed. *Shooters* (D. O. T. 5–74.030) are in charge of the placing and the detonating of explosive charges.

Gravity prospecting, another method of finding oil traps, makes use of the gravity meter. This instrument is an extremely sensitive scale that accurately measures the vertical pull of gravity. Heavy rocks near the surface pull harder than light ones, or heavy rocks at greater depth. The gravity meter, by detecting these variations, helps disclose the possible presence of oil-bearing structures. Workers employed in gravity prospecting include operators of gravity measuring instruments, draftsmen, computers, party chiefs, and surveying crews.

Another method of exploring underground rock is by electricity. A special electric probe is lowered into a well. A current is passed through the rock layers and the rock's resistance to the current is measured. Different kinds of rock have varying resistance to electricity. Resistance is affected also by the oil, gas, or water content of the rock. An electrical prospecting party usually has from 4 to 8 members, including the party chief, surveyor, operators of electrical measuring instruments, and cablemen.

The *landman*, or *leaseman* (D. O. T. 0–98.22 and 1–48.21), has essential functions in exploration and oilfield development. His job is to make the necessary legal and financial arrangements with the owners of prospective oil land in which his company is interested. Another important job in oil exploration is that of the *scout* (D. O. T. 1–48.22). He keeps his company informed on all explorations, leasing, drilling, and production activity in his area.

Drilling

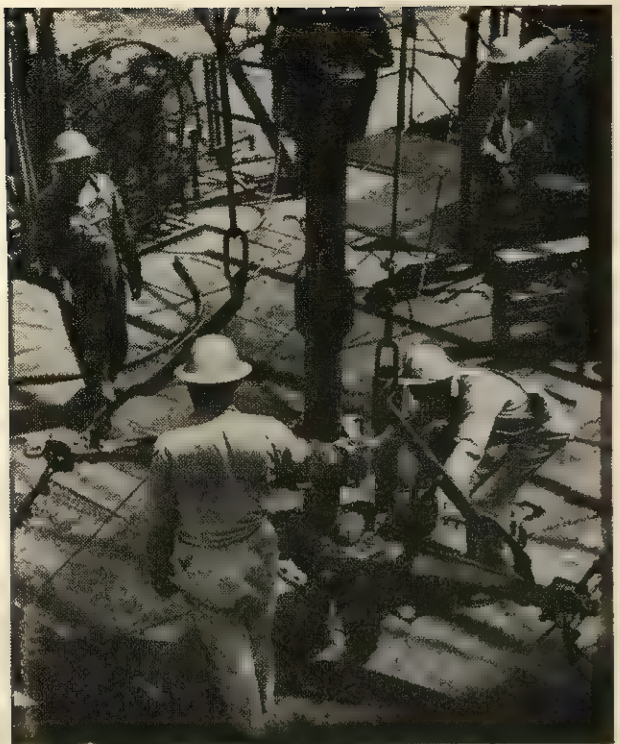
Despite all the exploration methods that have been developed, no device that will actually find petroleum has been discovered. Only by drilling can the presence of oil be proved. There are two methods of drilling a well: Cable-tool drilling and rotary drilling. No matter which method is used, all wells are started in the same way. First, a pit is dug for machinery and pipe connections. Rig builders and a crew of helpers erect a structure used to support machinery and drilling equipment. Then a derrick, which oilmen call a tower, is built.

Rig builders erect and dismantle the giant steel derricks.

Cable-tool drilling was the original method, but it has been replaced to a great extent by rotary drilling. At present the cable-tool method is mainly employed in drilling shallow wells in hard rock formations. Most of the cable-tool drilling is done in Pennsylvania, New York, Ohio, and West Virginia. In cable-tool drilling, a hole is pounded through the rocks by raising and dropping (over and over again) a heavy, sharpened bit attached to the end of a cable.

The usual cable-tool drilling crew consists of the driller and the tool dresser. The *cable-tool driller* (D. O. T. 5–75.270) is in charge of all operations during his tour of duty and maintains a detailed record of drilling activity. One of his main functions is to control the force with which the drilling bit strikes the bottom of the well. He also supervises and helps in the setting up of the machinery and derrick. The *cable-tool dresser* (D. O. T. 5–75.280) assists the driller and maintains the equipment.

Almost all the deeper wells are drilled by the rotary method. Rotary drilling bores a hole in the ground in much the same way that a carpenter bores a hole with a brace and bit into a board. The drilling bit is a steel tool having a cutting surface at its lower end. The bit is attached to a string of jointed hollow pipe which is rotated by



Rotary crew on the derrick floor removing drilling pipe.

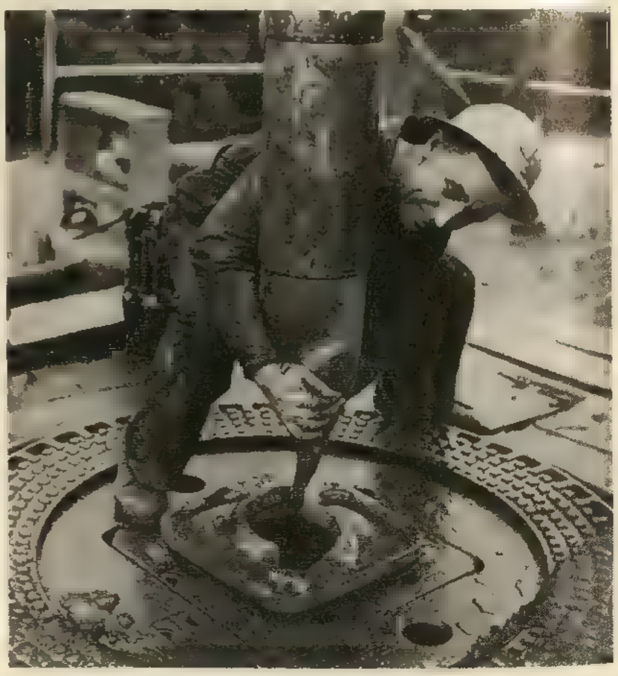
a steam, diesel, or gasoline engine. As the bit goes down, the drill stem is lengthened by the addition of more pipe which is screwed on at the upper end. A stream of mud is continuously pumped down through the pipe in order to cool the drill bit, to plaster the walls of the hole to prevent cave-ins, and to bring cuttings to the surface.

A typical rotary-drilling crew consists of a *rotary driller* (D. O. T. 5–75.050) and 4 or 5 helpers. To operate 1 rig the customary 24 hours a day, 7 days a week, from 15 to 20 workers are generally required. The rotary driller is in charge of the work of the crew during his tour of duty and operates the drilling machinery. His duties include controlling drilling speed and pressure, and keeping a record of operations. He must be ready to meet a variety of emergencies, such as breakdown of equipment or occurrence of unusual geological formations. His helpers include a *derrickman* (D. O. T. 5–20.825), a *fireman* (D. O. T. 7–70.070) (if steam is used), or *engineman* (D. O. T. 5–72.915) (if diesel or electric power is used), and 1 or 2 *rotary floormen* (D. O. T. 7–75.050). The derrickman is second in charge on the drilling rig. When pipe is being removed and replaced, the derrickman handles the upper end of the pipe, working on a small platform high on the rig. The rotary floormen handle the lower end, racking and unracking pipe sections and connecting and disconnecting pipe joints. The derrickman also controls the consistency and circulation of the drilling mud. The firemen or enginemen operate the engine which provides power for drilling.

Another important oilfield worker is the *tool pusher* (D. O. T. 5–93.310), who supervises the operations of a group of either cable- or rotary-drilling rigs. He also has the responsibility of supplying the drilling crews with needed materials and equipment. *Roustabouts* (D. O. T. 9–20.10) or general oilfield laborers, are not part of drilling crews, but are utilized to do odd jobs.

Well Operation and Maintenance

Production begins once oil is struck and begins to flow. Many different kinds of workers are employed in a producing field. *Switchers* (D. O. T. 5–20.600 through 20.699 and 7–20.610) work in fields where oil flows under natural gas pressures and does not require pumping. They open and close valves to regulate the flow of oil from wells to tanks, between tanks, or into pump lines. *Pumpers* (D. O. T. 5–72.570 and 7–72.570) operate and maintain power units, pumps, and other equipment used in producing an artificial flow of oil from the wells. This is the largest occupation



Rotary floorman installing bit on a rotary drill.

Pump switcher opening and closing valves to regulate the flow of oil from the well.

in the oilfields. Generally, a pumper operates a group of wells. *Gagers* (D. O. T. 6–55.060) measure and record the contents of the field tanks and take samples of the oil. In many fields, the same persons perform the job of switching, gaging, and pumping. *Treaters* (D. O. T. 5–20.400 through 20.599 and 7–20.410) test oil from wells for sediment and water content and use chemical or electrical equipment to treat oil in storage tanks. (This occupation may also be combined with pumper or gager.) *Roustabouts* perform the various field and well maintenance jobs, which require relatively little skill, but often involve heavy, hazardous work.

A number of workers are engaged in various specialized maintenance operations in the oilfields. *Welders*, *carpenters*, *electricians*, *machinists*, and *blacksmiths* are employed to repair and install equipment. (Discussions of these and other maintenance occupations are included elsewhere in this Handbook. See index for page numbers.)

Overall planning and supervision of drilling and production operations are usually responsibilities of the *petroleum engineer.* He helps to select drilling sites and directs rig builders and other workers in erection of the derrick and installation of the drilling machinery. He advises drilling personnel on technical matters and may supervise the completion of wells. One of his principal functions is to prevent waste by determining oil flow rates and production methods.

Other Oilfield Services

Companies engaged in oilfield contract services (other than drilling and exploration) on a fee basis provide another important source of employment. They perform such services as cementing and well cleaning; running, cutting, and pulling of casing tubes and rods. These contractors employ such skilled workers as *cementers* (D. O. T. 5–20.020) who mix and pump cement into oil well holes to seal space between steel casings and side walls to provide protection and control for underground operations; *acidizers* (D. O. T. 5–20.420) who force acid into formations of rock or earth to make the oil flow faster; *perforator operators* (D. O. T. 5–74.040) who perforate holes at various points in the well with controlled explosives to make passages for oil or other fluids used in drilling processes; *sample-taker operators* (D. O. T. 5–74.042) who obtain samples of earth formation from wells by using electrically ignited explosive gun devices. The samples are used to determine the presence of oil or oil-bearing formations. Also employed are well pulling crews who use mechanical winches to remove the pumping rods and steel casing from wells. This is done either to clean and repair pumping equipment or to salvage the casing when wells are abandoned.

Offshore Operations

Although most exploration, drilling, and producing are done on land, an increasing amount of these operations is being performed offshore, particularly in the Gulf of Mexico off Louisiana and Texas. Some wells have been drilled as far as 75 miles from shore and in as much as 100 feet of water. In addition to the same types of workers employed in land operations, radio men, able-bodied seamen, cooks and mess boys are employed.

Training, Other Qualifications, and Advancement

Exploration

The nonprofessional workers of a crew generally start as helpers and work into one of the specialized jobs after they have acquired experience. Their period of training on the job may vary from several months to several years. Employees are usually hired in the field by the party chief or local company representatives. Companies look

for workers with a high school education or its equivalent and for persons with training or aptitude in mathematics, drafting, and mechanics for many of their nonprofessional jobs. College students majoring in the sciences are often hired for part-time or summer work for these jobs. This may be a means of working into a full-time job after graduation.

As explained in the statements on individual occupations in the chapter on professional and related occupations, college training with at least a bachelor's degree is generally required for entry into professional occupations such as geologist, geophysicist, chemist, and engineer. (See index for page numbers for full information on qualifications.) Professional workers usually start at junior levels and, after 1 or more years of experience in field surveys, are eligible for promotion to party chiefs. After this experience they may advance to a position of responsibility in an area or division office and then perhaps to the central office. Persons with research ability may move to research or consulting work.

Drilling

Drilling crew members generally are hired as laborers or floormen. As they acquire experience and know-how they may advance to more skilled jobs. In rotary drilling, for example, a new man is hired as a floorman and he may advance to derrickman, and then to driller. It takes several years to attain the status of driller. Drillers can be promoted to the job of tool-pusher in charge of several drilling crews.

The work of the roustabouts, rotary floormen, and derrickmen, requires men capable of performing heavy physical labor. Drilling crew members are usually between the ages of 20 and 40; however, some companies report that their best drillers are over 50 and even in their 60's, for the job of driller primarily requires good judgment and practical experience rather than strength or agility.

Well Operation and Maintenance

Companies generally hire persons living in the vicinity for well operation and maintenance jobs. They prefer men with mechanical ability and a knowledge of oilfield processes. Because this type of work is less strenuous and offers the advantage of a fixed locale, members of drilling crews or exploration parties who prefer not to travel often transfer to well operation and maintenance jobs.

New workers may start as roustabouts and advance to jobs as switchers or gagers, or to pumper helpers and pumpers. Training is usually acquired on the job and at least 2 years' experience is necessary to become a good all-round pumper.

The preferred educational qualification for a petroleum engineer is a college degree with a specialization in courses dealing with the petroleum industry. However, college graduates with degrees in chemical engineering, mining, mechanical engineering, or in geology or other related sciences are sometimes hired for petroleum engineering jobs.

Employment Outlook

Employment in crude petroleum production should expand steadily during the late 1950's and the 1960's. Replacement needs will also create job openings for new workers.

Employment in petroleum production has been rising for many years (see chart 59). There was a particularly rapid growth of employment in the post-World War II period. From 1946 to 1956, employment increased from 220,000 to 330,000. The number of workers is expected to increase steadily in the 1956–66 decade—but at a slower rate than during the preceding 10 years. The growing number of automobiles, trucks, buses, airplanes, tractors, home heating units, and industrial users will increase the demand for petroleum products.

Although the demand for crude petroleum is expected to double between 1955 and 1975, domestic crude production may increase at a somewhat slower rate. The increasing costs of new petroleum discoveries and higher costs for developing domestic oilfields may possibly result in a greater proportion of our requirements for crude petroleum being supplied by imports. The amount of imported oil increased from less than 10 percent of consumption in 1950 to 15 percent in 1955.

The increased demand and output of crude petroleum should result in a steady growth of employment—at a faster rate than the growth of the Nation's total labor force. However, there may be differences in the growth of employment

in the 3 segments of crude petroleum production—exploration, drilling, and well servicing and maintenance. Their respective employment outlooks are discussed briefly below.

Exploration employment is expected to increase moderately during the late 1950's and the 1960's because of the need to search for additional sources of oil. The number of geophysical crews, a good index of exploration activity, reached a postwar peak in 1952 and then decreased slowly until 1955 when it again turned upward. The anticipated high level of exploration activity will result in job openings for geologists, engineers, computers, and other scientific and technical workers.

The increased demand for petroleum production should also result in greater drilling activity. The number of new wells and footage drilled has grown rapidly in recent years, reaching a peak of more than 57,000 wells and 234 million feet in 1956. During the 1956–66 decade, a continuing but slower increase in drilling employment is expected. Additional petroleum engineers and drilling crews will be needed during this period. Cementers, acidizers, and other specialized oilfield servicing jobs are also expected to increase during this period.

The greatest increase in employment in crude petroleum production is expected in well operation and maintenance—the largest segment of this branch of the industry. At the end of 1955, there were over 537,000 producing wells, 29 percent more than 10 years earlier. During the 1956–66 decade, the increasing number of operating wells is expected to result in a relatively large growth in well operation and maintenance employment. More pumpers and skilled maintenance workers will be needed for operation and maintenance jobs.

Besides job opportunities in petroleum production arising from the growth of this branch of the industry, replacement needs resulting from deaths, retirements, and transfers to other fields of work will also provide many openings for new workers. Deaths and retirements alone should result in about 5,000 to 7,000 job openings annually.

Future job opportunities should continue to be concentrated in those States with the largest number of producing wells and the highest reserves. These States are Texas, Pennsylvania, Oklahoma, California, Kansas, Louisiana, Wyoming, and New Mexico. While offshore activities in 1956 accounted for only a small portion of total production employment, they are expected to increase greatly in the late 1950's and the 1960's, particularly off Texas and Louisiana.

Earnings and Working Conditions

Earnings of oilfield workers are among the highest in American industry. In December 1956, weekly earnings of nonsupervisory employees in petroleum and natural gas production (excluding contract services) averaged $104.58 and their average hourly earnings were $2.52. This compares, for example, with an average of $84.05 a week and $2.05 an hour for production workers in all manufacturing industries in the same month.

Recent earnings information for individual occupations is not available. However, an examination of a number of 1955–56 union agreements, which cover only a small part of employment in petroleum production, indicates the following range of earnings in selected occupations. Among drilling employees, rotary drillers were generally earning from $3 to $3.65 an hour, derrickmen from $2.35 to $2.65, and rotary floormen from $2.10 to $2.50. Skilled well operation and maintenance employees, such as pumpers, switchers, and gagers, were earning from $2.30 to $3 an hour, and roustabouts about $2 an hour.

Most oilfield work is done outdoors and thus the workers are exposed to extremes in weather. Fields may be near cities; however, they are often far from sizable communities and are sometimes located in swamps or deserts. Drilling employees may expect to remain in one place a few years at most; their work in a particular field may be completed in less than a year. Exploration personnel move around even more frequently.

Exploration work is generally performed during daylight hours and crews often work more than 40 hours a week. Drilling is done around the clock and each well has a complete crew for each 8-hour shift. Work on the various shifts is usually alternated. Employees in well operation and maintenance usually work a basic 40-hour week.

In offshore operations, the basic wage rates are the same as in land operations. Except for the operations that are close to shore, workers' living quarters are on platforms held fast to the ocean bottom or on ships anchored near the operations. These quarters, as well as meals, are provided by the employer. Tours of duty vary from 3 to 12 or

more consecutive days, depending upon company policy and distance from shore, with an equal number of days off on land.

Accident data indicate that occupations in exploration and crude production are not particularly dangerous; they have a lower accident frequency rate, for example, than the average for all manufacturing industry. Drilling, on the other hand, is much more hazardous. However, during recent years improved equipment and drilling methods and special safety training have greatly reduced hazards.

Most oilfield workers are not union members. Some of the fields, however, have been organized by the Oil, Chemical and Atomic Workers International Union. The International Union of Operating Engineers and some independent unions have also organized oilfield workers.

Petroleum Refining Occupations

Nature of Work

Petroleum refining is the processing of crude petroleum into usable end products, such as gasoline, kerosene, fuel oil, and lubricants. This processing is carried on in plants called refineries which look very much like the apparatus for a gigantic chemical laboratory demonstration.

In its simplest form, petroleum refining consists of heating the crude oil to its boiling point. The vapors from the heated oil pass into condensing pipes to become the major products or "fractions" of petroleum, such as gasoline, distillates, and kerosene. In many refineries, large "cracking" units are employed to obtain more gasoline per barrel of crude oil. As its name implies, cracking breaks down, or rearranges, the molecules of heavy oils into lighter hydrocarbons. Cracking is accomplished in these units through the application of either great heat and pressure or heat plus the action of a catalyst.

About a third of the plant workers in a modern refinery are engaged in processing. Petroleum processing is highly automatic, and the operations within the pipes and ducts are controlled by many complicated instruments.

A key job in processing is that of the *stillman* (D. O. T. 4–55.030) or operator, who is responsible for the operation of one or more processing units. In order to control the operation of the equipment, he observes and records instrument readings showing the temperature, pressure, and oil flow. Another of his duties is to inspect the equipment


Operators in control room in fluid catalytic cracking unit check temperatures.


Pumpman adjusting temperature on heat treater for storage tank.

of his units. A stillman has one or more assistants (D. O. T. 6–55.020), depending on the number and size of the units.

Pumpmen (D. O. T. 5–72.550) and their *helpers* (D. O. T. 6–55.930) maintain and operate power-driven pumps which circulate petroleum products, chemicals, and water through units during processing. Impurities present in gasoline, oil, and other products are removed in purification units run by *treaters* (D. O. T. 4–55.310).

More than half of the plant workers in a typical refinery are employed in repairing, rebuilding, and cleaning operating equipment. Included among these are skilled *boilermakers*, *bricklayers*, *carpenters*, *electricians*, *instrument repairmen*, *lead burners*, *machinists*, *painters*, *pipefitters*, *pipe coverers*, *riggers*, *sheet-metal workers*, and *welders*. There are also many helpers and trainees in these trades. (Detailed descriptions for many of the above-mentioned maintenance occupations may be found elsewhere in this Handbook. See index for page numbers.)

In addition to processing and maintenance jobs, a number of workers are employed in the packaging and shipping departments. A typical job in the packaging department is that of a *wax packer* (D. O. T. 8–55.01) who tends a machine that packs wax—one of the byproducts of petroleum—into shipping containers.

Petroleum refining employees include a relatively large proportion of professional and technical workers. Among these are chemists, chemical engineers, mechanical engineers, laboratory technicians, and draftsmen. Some of these are employed in separate research laboratories frequently located in communities other than those in which the refineries are located.

Chemists control the quality of petroleum products by conducting tests and analyses to determine chemical and physical properties. Many chemists are engaged in research and development of new products and processes. Some *laboratory technicians* assist the chemist in research projects; others do routine testing and sample taking.

Engineers are employed in a variety of refinery activities, including design of chemical equipment, supervision and development of processes, plant layout, and quality control. *Draftsmen* prepare working plans and detailed drawings required in refinery construction and maintenance. (Detailed descriptions for many of the above-mentioned professional and semiprofessional occupations may be found elsewhere in this Handbook. See index for page numbers.)

Pipefitters installing a control valve in a refinery.

Petroleum refineries also employ a wide variety of administrative, clerical, and other white-collar personnel. Among these employees are accountants, bookkeepers, statistical clerks, purchasing agents, market specialists, secretaries, stenographers, and business-machine operators. In addition, refineries employ truckdrivers, guards, janitors, and material handlers.

Training, Other Qualifications, and Advancement

Plant workers are generally hired as laborers or trainees. However, a qualified journeyman may be hired directly into one of the craft jobs, such as machinist or electrician, when no trainees are qualified and available for promotion.

Psychological testing and interviewing are used in selecting employees in the larger refineries. The equivalent of a high school education is required by many employers.

A new worker is generally assigned to a labor pool and then transferred to one of the processing or maintenance departments as vacancies occur. Here, the more skilled work is learned on the job, with advancement by seniority and merit. For example, in a processing department, a worker may advance in this order: laborer, helper, assistant stillman, stillman. In maintenance departments, a worker advances from laborer to helper or learner. Over a period of 3 or 4 years, he is trained to become skilled in such work as boilermaking, pipefitting, or welding. Some refineries have formal apprenticeship programs to train workers for skilled maintenance occupations.

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As is true of professional occupations in petroleum production, a college degree is generally the minimum requirement for chemists, chemical engineers, and other scientific jobs in petroleum refining. Applicants with graduate training and degrees are preferred for research and development work. (See index for reference to detailed information on individual occupations.)

Employment Outlook

Refinery employment should expand steadily during the late 1950's and the 1960's. The rate of increase is expected to be somewhat greater than the overall growth of the Nation's labor force. Job openings will also result from replacement needs.

Increased refinery output will be necessary to supply the petroleum products required by the steadily growing number of automobiles, airplanes, tractors, home heating units, and industrial users. It has been estimated that the demand for petroleum products may double in the two decades between 1955 and 1975. However, employment will grow at a much slower rate than refinery output. This has been the long-range experience in petroleum refining. For example, between 1920 and 1946, output increased twice as fast as employment. In recent years, the difference in the rate of growth has been even more extreme. From 1946 to 1955, output increased 57 percent, although employment increased only 14 percent. The industry's emphasis upon improved technology, and the trend toward larger and more automatic refineries will result in employment of fewer workers per unit of output during the 1956–66 decade. Some of the effect of this improved technology will be offset by the trend of the larger refineries toward the performance of more processing operations which require additional personnel.

The emphasis on research and development and the increasing use of instrumentation and automatic equipment in processing operations will affect differently the rates of growth of individual occupational groups. The number of administrative and technical workers, particularly chemists, chemical engineers, and technicians, is expected to grow faster than the number of plant workers. Among plant workers, the largest increase in employment is expected to be among maintenance workers, such as instrument mechanics, pipefitters, machinists, and maintenance electricians. Increasing employment in these occupations will be a continuation of a trend which has been evident in this industry in the post-World War II period.

In addition to the openings resulting from the expected expansion in refining, replacement needs resulting from deaths, retirements, and transfers into other fields of work will provide many job opportunities for new workers. Deaths and retirements alone will result in about 3,500 to 4,500 job openings annually. Most new plant workers will start as laborers, since the usual practice in refineries is to fill the more skilled jobs by promoting from within.

Earnings and Working Conditions

Refinery workers are among the highest paid employees in American industry. In December 1956, production workers in petroleum refining earned, on the average, $109.74 a week and $2.67 an hour. In the same month, the average for all manufacturing industries was $84.05 a week and $2.05 an hour.

Although comprehensive wage data are not available for individual occupations, an examination of a number of 1955–56 union agreements in some of the larger refineries indicates the following range of hourly rates in selected plant occupations:

Stillman (chief operator)	$2.70–$3.20
Assistant operator	$2.25–$2.85
First helper	$2.25–$2.85
First class:	
Lead burner	$2.70–$3.20
Instrument man	$2.45–$3.15
Mason	$2.30–$3.80
Welder	$2.30–$3.20
Electrician	$2.30–$3.00
Boilermaker	$2.30–$3.00
Carpenter	$2.30–$3.00
Machinist	$2.30–$3.00
Treater	$2.75–$3.20
Pumpman	$2.50–$3.00
Laborer	$1.50–$2.30

Employees generally receive additional pay when they work on the second or third shifts. Most petroleum refinery workers are granted vacations with pay after 1 year's service. A large number of the companies have adopted some types

of insurance, pension, or health insurance plans for their employees. Employee stock-purchase plans and savings plans, to which the company makes contributions, are in effect in many firms.

The starting salaries for chemists and other professional personnel depend upon the size of the company, the type of job, the academic degree, and particular specializations. The petroleum industry's entry salaries for engineering and other professional personnel are among the highest in American industry. A 1956 survey by the American Chemical Society indicated that the median (average) starting salary for chemists with a bachelor's degree was $427 a month, and for chemical engineers with a bachelor's degree it was $435 a month. Chemists and chemical engineers with graduate degrees receive higher starting salaries. For example, the 1956 survey showed that chemists with a doctor's degree received a starting salary of $600 a month.

There is considerable variety in the working conditions in refineries. Although most refinery jobs require little physical effort, some workers have to open and close heavy valves and climb stairs and ladders to considerable heights in the course of their duties. Others work in hot places or are exposed to unpleasant odors. Refineries are relatively safe places in which to work. The accident-frequency rate in refineries is about half that of manufacturing as a whole.

Because refineries operate 24 hours a day and 7 days a week, processing workers may be assigned to any 1 of the 3 shifts—often on a rotating basis—and to Sunday and holiday work.

A majority of refinery plant workers are union members. A large number of refineries have been organized by the Oil, Chemical and Atomic Workers International Union. Some refinery workers are also members of other AFL–CIO unions and various independent unions.

OCCUPATIONS IN PLASTIC PRODUCTS MANUFACTURING

The Plastic Products Industry and Its Workers

Plastic products are used in thousands of civilian, industrial, and military items and are produced by one of America's faster growing industries. Employment in this industry has grown from 18,000 in 1940 to more than 86,000 in 1956. The value of the industry's products exceeded $1.5 billion in 1956.

Most of the plant jobs require little skill and can be learned in short periods of on-the-job training. The industry, however, employs several thousand tool and die makers, skilled maintenance workers, and a small number of engineers and draftsmen who require years of training, experience, and education for their jobs. About one-third of the workers in this industry are women.

Nature of the Industry and Its Products

Plastics are synthetic organic materials manufactured from substances such as coal, petroleum, wood, or cotton, which, through the application of pressure or heat, or both, can be formed into almost any desired shape. Although not entirely of recent origin, plastics are primarily the products of modern research.

Plastics are easy to shape and have many other useful properties. Generally, they are light, resistant to corrosion, easy to color, odorless, and adaptable to mass production. Some plastics are noted for toughness, electrical insulating qualities, transparency, flexibility, or resistance to water. Because of their unusual qualities, they have been put to thousands of uses. Some typical plastic products include radio cabinets, telephone headsets, electrical switch parts, gears, bottle tops, light reflectors, medical instruments, refrigerator parts, instrument panels, chemical tubing, novelties, and toys.

Most of the industry's output consists of plastic parts made to order for other plastics firms, or factories in other industries making such products as electrical machinery, automobiles, aircraft, or communications equipment. Other plastic products, such as novelties, toys, combs, and bottle tops, are sold in finished form.

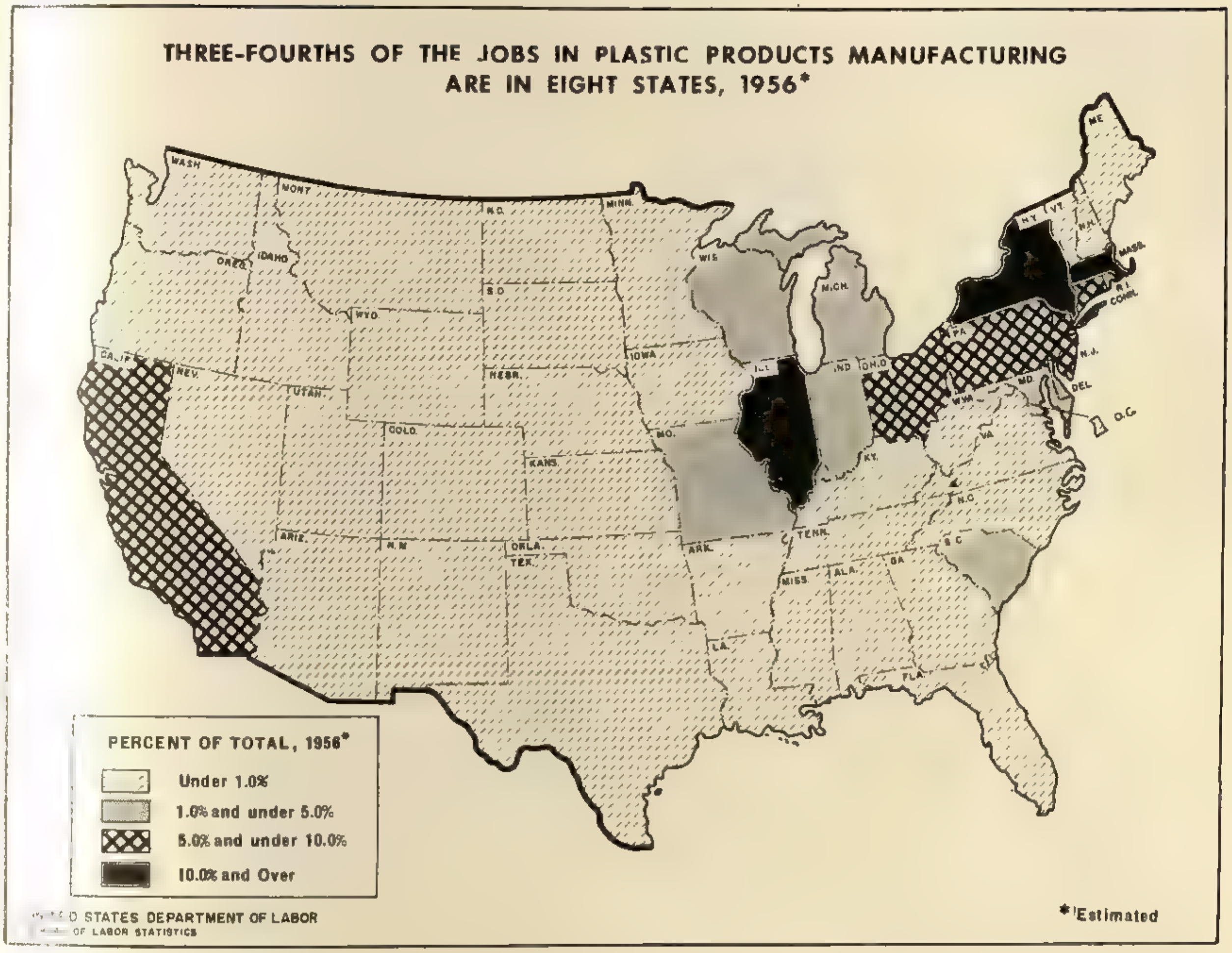
Not treated as part of the industry are the plastic materials producers (part of the chemical industry) who supply molding compounds to molding plants; laminating resins to laminating plants; and plastic sheets, rods, and tubes to fabricating plants. Certain other producers are not considered part of the plastic products industry even though their jobs and production methods correspond. These producers are: (1) the plastics departments of companies such as automobile and electrical machinery manufacturers which make plastic parts for use in their final product and (2) plants producing a particular type of plastic product, which is closely identified with another manufacturing industry. For example, plants making plastic buttons are considered part of the button industry.

The 2,500 plants in the plastic products industry vary in size from those run by their owners with 1 or 2 helpers, to a few large plants with more than 1,000 employees. Most of the plants are small. They are found principally in the more important industrial regions. In 1956, these plants were found in 43 States but, as chart 62 shows, about three-fourths of the workers were employed in 8 States: Illinois, New York, Massachusetts, Ohio, New Jersey, Pennsylvania, California, and Connecticut.

Typically, large numbers of each item are manufactured; for example, a plant may have an order for many thousands of identical bottle caps or fountain pen barrels. It is usually not economical to mold plastic products in small quantities, because of the high cost of the individual molds used in their manufacture. Therefore, quantity production in molding is the rule, even in the smaller plants. Without mechanization and quantity production, the cost of such articles would be prohibitive and their widespread use impossible.

The principal methods of forming plastic products are molding, lamination, and fabrication. In molding, the most widely used process in the industry, the plastic is made pliable through pressure or heat and pressed by various techniques into a mold where it hardens into the desired shape.

CHART 62



Lamination is a process in which layers of wood, paper, or cloth are impregnated with liquid resins and fused into flat sheets of various shapes to make such items as table tops, partition walls, or pipe. Fabricators convert plastic rods, tubes, and other special shapes into finished products such as handles or counter displays by sawing, machining, or other fabricating methods.

Plastic Products Industry Occupations

The types of jobs in a particular plant depend upon the plastic products made, the processes used, and the size and organization of the plant. Because most plants restrict themselves to one of the major processes, few plants have all the types of jobs found in this industry. However, the larger plants which use more than one of the different manufacturing processes and may, in addition, have a tool or machine shop and a research department, have a greater variety of jobs. Finishing and inspection jobs as well as office and sales positions are found in almost all plants. Some of the important occupations in this industry are described below.

Occupations in Molding Plants

The industry's largest group of workers are employed in molding operations. Most of these employees are semiskilled and operate compression, injection, or extrusion molding machines which form plastic articles or parts. Other large numbers of molding department workers are employed in finishing and inspection jobs.

The basic duties of the molding machine operators are to feed plastic materials into the molding machine, start the machine, and take out the molded pieces. The molding machine operators are designated according to the type of molding

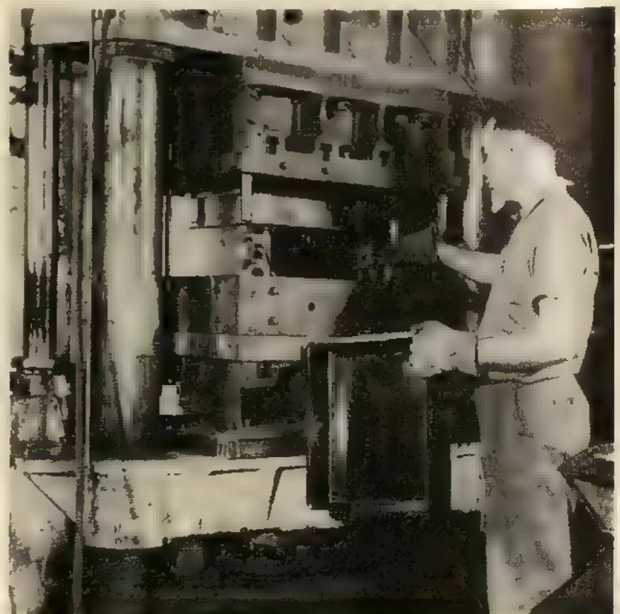
Loading preformed plastic forms into a mold to make washing machine agitators. About one-third of the employees in the plastics products industry are women.

machine operated—*injection molding machine operator* (D. O. T. 7–10.016), *compression molding machine operator* (D. O. T. 7–10.014), or *extrusion machine operator* (D. O. T. 6–51.468). In the larger plants, there is also a *setup man* (D. O. T. 7–83.326) who makes the machines ready for the operators by setting the controls and positioning the molds. He regulates the heat and pressure controls, and makes the other adjustments to the machine as required from time to time. In the smaller plants, the operator performs the setup work.

Finishing Jobs. Molded plastics generally undergo a series of finishing operations before they are ready for use. In these operations, the rough edges are removed and decorations or designs are added to the plastic products. *Tumbling barrel operators* (D. O. T. 9–10.10) place molded pieces in wire tumbling barrels containing polishing materials and start the tumbling machine. The rotating motion of the barrel rubs the pieces against one another and against the polishing material, which gradually removes excess plastic material. *Bench grinders* (D. O. T. 6–77.710) hold the molded articles against rotating abrasive wheels to remove excess material. *Hand filers* (D. O. T. 9–10.10) use files or carbon spindles to smooth edges and remove excess material. *Buffers* (polishers) (D. O. T. 6–77.020) polish articles to a high luster by holding them against rapidly rotating wheels. *Drill press operators* (D. O. T. 8–78.14) drill holes in plastic pieces and clean the excess material from holes. In some plants, a number of *assemblers* (D. O. T. 9–10.10) are employed to put together molded pieces or add decorations in the making of such finished products as goggle frames, umbrella handles, and containers.

Inspection Jobs. Plastic products must be inspected before they leave the plant. The amount of inspection differs widely, depending upon the plastic product being produced. For some molded products, the workmen need only look over the article for blisters or improper finish. Other products must be examined more closely to see whether they meet more exact specifications. *Inspectors* (D. O. T. 7–10.415) use measuring instruments such as micrometers, dividers, and various types of gages to judge whether finished products are made according to precise specifications.

Toolroom Jobs. Although most molding plants buy their molds from firms specializing in this operation, some molding plants, especially the larger ones, make their own molds. These plants, therefore, have toolrooms in which *tool and die makers* (D. O. T. 4–76.010) and *machinists* (D. O. T. 4–75.010) are employed. Although these workers make up only a small part of the industry's work force (slightly more than 3,000 in 1956), they are



Plastic molding machine operator removing compression molding of plastic drawers.

the main group of skilled workers employed by plastic products manufacturers.

Tool and die makers use machines and handtools to shape molds from steel. They must be able to read blueprints, use precision measuring instruments, and set up and operate various machine tools, such as lathes and boring mills. Machinists recondition and repair worn or damaged molds and make replacement parts for the various machines in the plant. Machinists must also be able to set up and operate machine tools.

Laminating Occupations

Three typical jobs in laminating work are those performed by coaters, press operators, and mandrel men. The *coater* (D. O. T. 6–51.508) operates the machine that impregnates paper or fabrics with synthetic resins. He places large rolls of paper on the coating machine and directs the course of the material through a resin bath and drying ovens. The dried material is then wound on rolls or cut into sheets. A *laminating press operator* (D. O. T. 6–51.510) runs a hydraulic press which produces sheets of plastic material by pressing the layers of resin-impregnated paper, textile, or other material between steel plates. The operator regulates heat and pressure controls and lowers and raises the press. Where fully automatic equipment is used, the operator's chief function is to check the controls to see that the press is functioning properly. In plants making laminated plastic tubing, a *mandrel man* (D. O. T. 6–51.512) tends a semiautomatic machine which winds resin-impregnated paper or fabric onto heated cores (mandrels). He regulates the thickness of the tube by using simple gaging tools. After the desired thickness is reached, he stops the machine and cuts the material. The tube is then taken to an oven for baking where the process is completed.

Fabricating Occupations

The types of jobs within a fabricating department or plant depend to a great extent upon the plastic material used for manufacturing. When rigid plastic material such as rods and tubes is used, the work is similar to that performed in a woodworking or light-metal production plant. Employees are engaged in bending, beading, buffing, painting, sawing, sanding, drilling, and turning. Some fabricating plant employees are *drill press operators* (D. O. T. 8–78.14), *lathe operators* (D. O. T. 7–10.222), *assemblers* (D. O. T. 7–10.217), and *finishers* (D. O. T. 7–10.220).

Other Plant Occupations

Some of the other plant workers employed in plastics plants drive trucks and tractors to make deliveries within the plant; some load and unload materials on trucks or trains; and some keep records on inventories of stock and tools. The industry also employs custodial workers such as *guards*, *watchmen*, and *janitors* whose jobs are similar to those in other industries.

Many plants in the industry also employ a maintenance staff consisting of one or more *machinists*, *millwrights*, *steamfitters*, *welders*, or *electricians* to maintain and repair machinery and equipment. In most plants, however, a machine operator or other production worker may do machine repair and maintenance work in addition to his other duties.

Technical, Office, and Sales Occupations

The plastic products industry employs a relatively small number of professional and technical personnel, since most of the research and developmental work on plastics is done by the large chemical firms. Some of the larger plants, however, do employ technically trained people, such as *chemists*, *engineers*, *designers*, and *draftsmen.* (Statements on many of these occupations are included in this Handbook. See index for page numbers.) Most technically trained workers employed in this industry are concerned with developing new plastic products and improving old ones.

Plastic products companies also employ *salesmen* who must know the properties of plastic products so that they can sell them to purchasing agents and production men in competition with other materials. *Production superintendents* are employed by many plants to plan and oversee plant operations, and keep the plant running efficiently. *Clerks*, *bookkeepers*, *accountants*, *typists*, and *purchasing agents* are among the workers employed in the business offices of plastic products firms.

Training, Other Qualifications, and Advancement

Because production methods of the plastic products industry are highly mechanized, most of the

jobs are semiskilled and unskilled. With the exception of toolroom and maintenance jobs, previous experience or special training is not required for plant work. The general practice is to hire inexperienced persons and train them on the job. The training period for most of the jobs varies from several days for the less skilled finishing or inspecting jobs to several months for the more skilled molding and laminating operator jobs.

Tool and die makers and machinists learn the skills of the crafts while they are working with experienced craftsmen or through apprenticeship programs. The tool and die maker apprenticeships generally last 4 or 5 years. The programs include practical work experience and classroom instruction in related subjects. In selecting apprentice applicants, most employers prefer young men with high school or vocational school education. In addition, some employers test the apprentice applicants to determine their mechanical aptitudes and mathematical abilities.

Most maintenance workers learn their trade by working as helpers to experienced craftsmen. However, formal apprenticeship programs are available for some maintenance occupations. (Detailed discussions of the duties, training, and employment opportunities for tool and die makers, machinists, and individual maintenance occupations appear elsewhere in this Handbook. See index for page numbers.)

A college degree in chemistry or engineering is generally required for most professional and technical jobs. Salesmen, often called sales engineers, are also required to have some technical training since a knowledge of the properties of plastic materials and the industrial possibilities of their uses are necessary in selling their company's products.

Employment Outlook

The plastic products industry is expected to provide thousands of job opportunities for new workers during the late 1950's and the 1960's. The industry's employment is expected to increase at a faster rate than the Nation's total labor force. Employment opportunities should also result from the need to replace workers who die, retire, or transfer out of the industry.

This industry has had a particularly rapid expansion in recent years. New plastic products and the greater use of plastics as a substitute for wood, glass, light metals, rubber, and other materials in consumer and industrial goods resulted in a fifteenfold increase in the industry's value of output between 1939 and 1954. Employment has also shown a rapid growth—increasing from about 18,000 in 1939, to 48,000 in 1947, and to more than 86,000 in 1956. The increasing use of plastics by the automobile industry typifies this growth. The 1956 automobile contained an average of 11 pounds of plastics—twice the amount used in the pre-World War II models.

Continued expansion in the production of plastic products is anticipated in the late 1950's and the 1960's. Plastic products are expected to do more than maintain their foothold in present markets, and the new uses of plastics currently being developed will result in entirely new markets for this industry. The high level of activity expected for the automobile, aircraft, electronics, and other important industries which use plastic products should contribute to the continued growth of this industry.

Although employment in the plastic products industry is expected to increase substantially during the late 1950's and the 1960's, it is not expected to expand as rapidly as production. This has been the industry's experience in recent years. For example, production increased approximately twice as fast as employment from 1947 to 1954. This difference is the result of the growing use of automatic equipment and laborsaving processes. Despite the anticipated continuation of mechanization, the industry is expected to provide thousands of jobs for new workers in the 1956–66 decade.

Most of the new job openings will be for inexperienced persons who can be trained for production jobs, but there will also be a small number of openings for toolroom, maintenance, and technical personnel.

Earnings and Working Conditions

Production workers in the plastic products industry averaged \$1.88 an hour and \$78.21 a week in December 1956. This compares with average hourly earnings of \$2.05 and weekly earnings of \$84.05 for production workers in all manufacturing industries in the same month. The lower average earnings for production workers in the plastic

products industry apparently reflect the high proportion of semiskilled and unskilled workers employed in this industry.

Although comprehensive data are not available for individual occupations, the following wage data collected from some molding manufacturers indicates the range of straight-time hourly rates for males in selected plant occupations in the spring of 1956:

Toolmaker, first class	\$1.80–\$3.40
Steam fitter and millwright	\$1.50–\$3.00
Compression molder	\$1.50–\$2.40
Compression molder, learner	\$1.20–\$1.70
Setup man	\$1.45–\$2.40
Injection molder	\$1.20–\$2.00
Injection molder, learner	\$1.10–\$1.70
Lathe finish operator	\$1.20–\$1.90
Buffer	\$1.10–\$2.40
Inspector	\$1.35–\$2.20

Many plants operate three shifts. Generally, a premium of 5 cents an hour is paid for the second shift and 10 cents an hour for the third. Almost all plants provide their employees 1 week's vacation with pay after 1 year of service. Up to 6 paid holidays a year are given by most plants.

Working conditions in plastic products plants are usually good, compared with factory work in general. The buildings are often modern, well lighted, and adequately ventilated. However molding departments tend to be noisy, and molding machines generate considerable heat. The operators have to wear gloves, since they handle hot plastic pieces. In laminating plants, the odor from the laminating solution may be disagreeable, and the heat near the presses may be bothersome.

The work in this industry is not particularly dangerous. The accident-frequency rate in 1955 was about the same as that for manufacturing as a whole.

Many workers in this industry belong to labor unions. Among the unions which represent workers in plastic products plants are: United Rubber, Cork, Linoleum and Plastic Workers of America; International Association of Machinists; and United Textile Workers of America.

Where To Go for More Information

More detailed information concerning the plastic products industry can be obtained by writing to:

The Society of Plastics Industry, Inc.,
250 Park Ave., New York 17, N. Y.

RADIO AND TELEVISION BROADCASTING OCCUPATIONS

The Broadcasting Industry and Its Workers

Every minute of the day and night in all parts of the Nation, radio or television programs are being sent into American homes. The tremendous impact of these broadcasting services in providing entertainment, information, and vital communications has made this industry very attractive to young persons interested in choosing a career. Although broadcasting employment has expanded considerably in recent years, this is still a relatively small field of work, with about 80,000 workers in mid-1956.

Broadcasting stations offer a variety of interesting jobs in communities all over the country. Generally, the most specialized and best paying jobs are concentrated in the nationwide networks and their stations, which produce most of the elaborate and expensive shows. However, opportunities to enter broadcasting occupations are better in the smaller communities and in the smaller stations.

Nature and Location of the Industry

In mid-1956, more than 2,900 radio stations and about 460 television stations were broadcasting from cities and towns throughout the United States. About two-thirds of all broadcasting workers were employed in radio and one-third in television.

Most broadcasting stations are independently owned. Many are affiliated with networks which supply programs to the individual stations on the basis of contracts which provide for sharing the costs and revenues of the programs. This arrangement makes it possible for these network "affiliates" to broadcast programs which would be much too expensive for them to originate individually. It also enables the networks to offer advertisers national coverage, and, as a result, to finance and produce a great variety of costly programs.

Radio stations are served by 4 nationwide networks and more than 80 regional and area networks. The nationwide networks, which originate most of the "live" programs, have affiliated stations in almost every metropolitan area. The regional networks are much smaller, though a few of them include as many as 50 stations. Their network activity usually consists of merely interconnecting for certain events, such as baseball games. Regional and area networks generally do not employ fulltime network personnel; their activities are conducted by staff employees of member stations.

Three nationwide television networks provide program service to affiliated commercial stations. Many individual television stations are affiliated with 2 or 3 of these networks in contrast to radio, where stations are usually affiliated with only 1 of the large networks. Since television stations are considerably more expensive to operate than radio stations, many smaller cities are able to support only 1 or 2 stations. Thus, the stations in these areas often affiliate with 2 or 3 networks in order to offer their viewers a wider variety of programs. Many television programs are broadcast simultaneously from more than 100 stations throughout the Nation.

Radio stations generally have much smaller staffs than television stations. In January 1955, radio stations had, on the average, about 18 employees, whereas television stations had about 56. However, the size of the staffs of individual stations varied greatly. More than two-thirds of all radio stations had fewer than 15 employees, almost one-fourth of them had 15 to 30, about 5 percent had 31 to 50, and only about 3 percent had more than 50 employees. In contrast, only about 15 percent of the television stations had fewer than 15 workers, about 28 percent had from 15 to 30, 25 percent had from 31 to 50, and over 30 percent had more than 50. Some of the largest television stations had more than 300 employees.

Almost every community in the United States with a population of over 10,000 has at least 1 broadcasting station, and a few of the largest cities have more than 20. Practically all of the large stations are located in metropolitan areas but small stations are found in big cities as well as in smaller communities. Radio and television broadcasting jobs are found in every State in the Nation. New York and California, which have

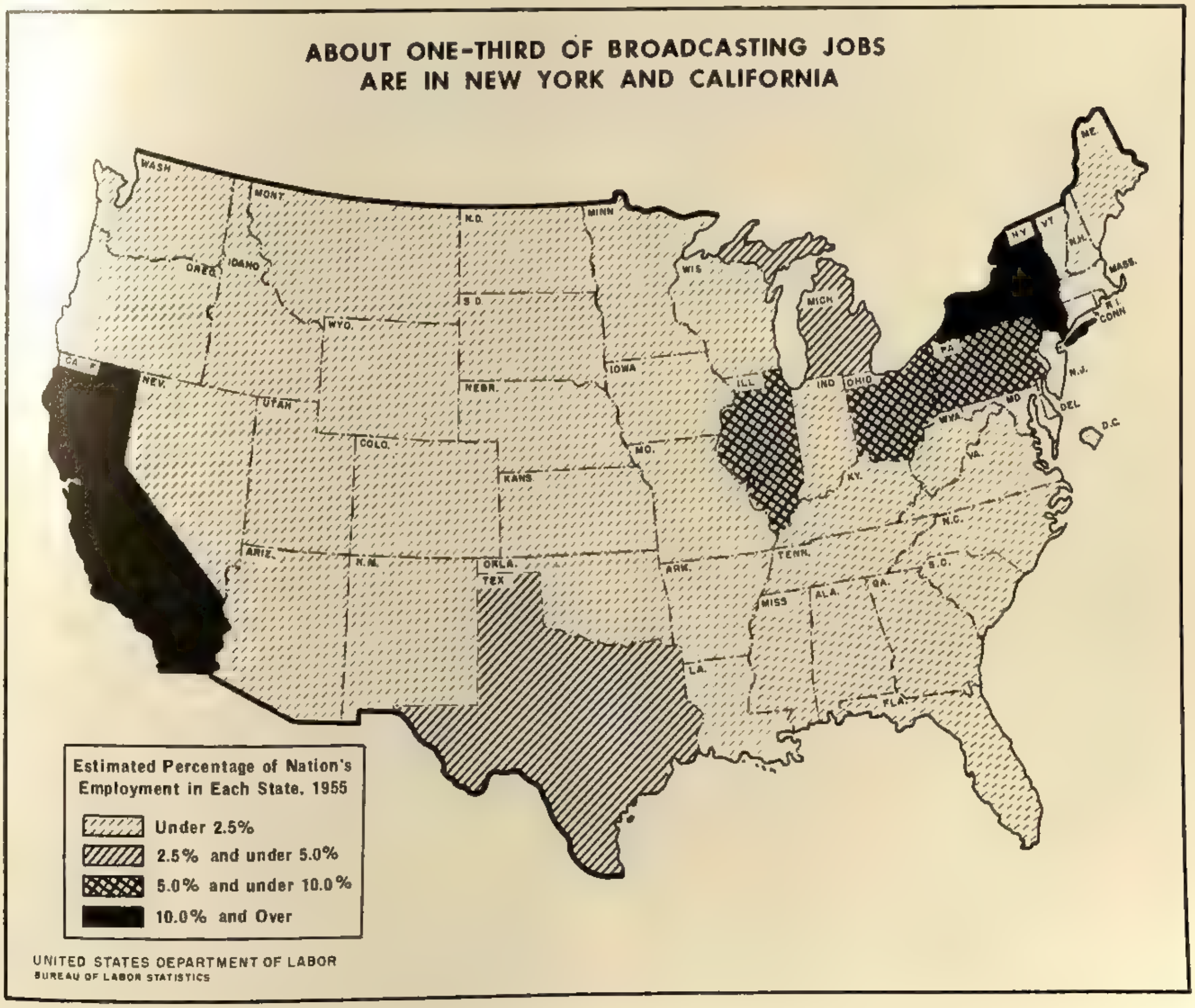
Large concentrations of broadcasting workers in New York City and Los Angeles, the network originating centers, account for about one-third of broadcasting employment. (See chart 63.) States which are large in area and heavily populated, such as Texas, Pennsylvania, and Ohio, also have many broadcasting workers because of the large number of individual stations.

Broadcasting Occupations

Broadcasting employees do four general types of work. Program employees prepare and present programs; engineering workers operate and maintain the equipment which converts the sounds and pictures into electronic impulses that can be picked up on home receivers; sales workers sell time to advertisers and agencies; and the remaining employees handle general business matters, such as accounting, public relations, legal affairs, and personnel administration.

In the broadcasting industry as a whole, more than one-third of all full-time employees are in programming work. Engineering personnel make up over one-fourth of broadcasting employment. Sales, publicity, and promotion workers account for about 12 percent, and the remaining workers—about 28 percent—are in the business management department. Of course, individual stations have staffing patterns which differ considerably from the average. Broadcasting stations have staffs ranging from fewer than 5 persons in a small town radio station to more than 300 in the largest television stations. Consequently, job duties and work organization vary

CHART 63



extremely from the smallest to the largest stations.

In the small stations, a large proportion of the broadcasts consist of transcribed music and news announcements. If the station is affiliated with a network, often more than half of its time on the air is devoted to network shows. As a result, small stations generally have only a few workers who perform a variety of tasks. The station manager, who in many cases is also the owner, may act as business and sales manager, program director, announcer, and script writer. Announcers in small stations usually do their own writing, often operate the studio control board, and may even act as salesmen. The engineering staff may consist of only one full-time broadcasting technician assisted by workers from the other departments on a part-time basis.

In the larger stations, jobs are much more specialized and are usually confined to 1 of the 4 departments. The kinds of jobs found in each of these departments are described below.

Programming Department. The programming department plans, prepares, and presents radio and television programs. Full-time station employees plan the station's programming, produce the daily and weekly shows, assign personnel to cover special events, and provide general program services such as music, makeup for television performers, sound effects, and lighting. In addition to these station employees, actors, comedians, singers, dancers, top-level announcers, and other entertainers are hired for specific broadcasts or series of broadcasts or for special assignments running over a fixed period. These "free-lance" artists work on a contract basis for either the station or network or for an advertising agency, sponsor, or "program production" company. (Free-lance artists are not considered staff employees and are therefore not included in broadcasting industry employment figures. Most entertainers in radio and television also work in other media, such as the legitimate theater, night clubs, or motion pictures.)

The size of a station's programming department depends not only on the size of the station, but also on the extent to which it broadcasts recorded, filmed, or networked shows. In the small stations, the program functions are handled by a few people who make routine and commercial announcements, read news and sports summaries, select and play recordings, and introduce network programs. A large television station, on the other hand, may have a program staff consisting of more than 50 people in a wide variety of specialized jobs.

Responsibility for the overall program schedule of a larger station rests with the *program director.* He arranges for a combination of programs that will be most effective in meeting the needs of advertisers who buy the station's services and will at the same time be most attractive and interesting to members of the community served by the station. He determines and administers the station's programming policy.

Individual programs or series of programs are planned and supervised by the *director.* In the largest stations, he may work under the supervision of the *producer*, who assumes responsibility for selection of scripts, financial control, and other overall problems of production. Sometimes these functions are combined in the job of *producer-director.* Selecting appropriate artists and studio personnel, scheduling and conducting rehearsals, coordinating the efforts of all the people involved in the show to produce effective entertainment, and directing the on-the-air show are the director's major responsibilities. He may be assisted by an *associate director*, who takes over such tasks as working out detailed schedules and plans, arranging for distribution of scripts and changes in scripts to the cast, and assisting in directing the on-the-air show. To aid in carrying out the orders of the director and his associates, some stations employ *program assistants*, who help assemble and coordinate the various parts of the show. They arrange for obtaining props, makeup service, art work, and film slides. They assist in timing the on-the-air show, preparing cue cards from the scripts and using them to cue the talent on the show. A considerable proportion of associate directors' and program assistants' jobs are held by women.

Announcers are the largest and best known group of program workers. In radio and television stations of all sizes, the announcer introduces programs, guests, and musical selections, and delivers most of the commercial messages. (Detailed information on duties, employment outlook, and earnings and working conditions of announcers is given later in this chapter.)

Music is an essential part of radio and television programming. Both small and large stations use recordings and transcriptions to provide musical

programs and background music for other shows. Large stations, which have extensive music "libraries," often employ a *music library clerk*, who maintains the music files and answers requests for any particular selection or type of music. In addition to recorded music, the larger stations have specialized personnel who plan and arrange for musical services. The *musical director* selects, arranges, and directs suitable music for programs on general instructions from the director. He selects musicians for live broadcasts and directs them during rehearsals and broadcasts. Musicians are generally hired for particular assignments on a free-lance basis. A few stations employ full-time staff musicians.

Staging a television show is similar in many respects to preparing a program or drama for the legitimate theater. Stations which originate live television shows must have staff members capable of handling the staging jobs. The *studio supervisor* plans and supervises the setting up of scenery and props and other studio and stage equipment for broadcasts. The *stage manager* plans and directs the actors' positions and movements on the set in accordance with the director's instructions, relaying stage directions, station breaks, and cues. These two jobs are often combined. *Makeup artists* prepare personnel for broadcasts by applying proper makeup, and maintain supplies and facilities necessary for this work. *Scenic designers* plan and design settings and backgrounds for programs. They select furniture, draperies, pictures, and other properties to help convey the visual impressions desired by the director. *Sound effects technicians* operate special equipment to simulate sounds, such as gunfire, thunder, or falling water, during rehearsals and broadcasts.

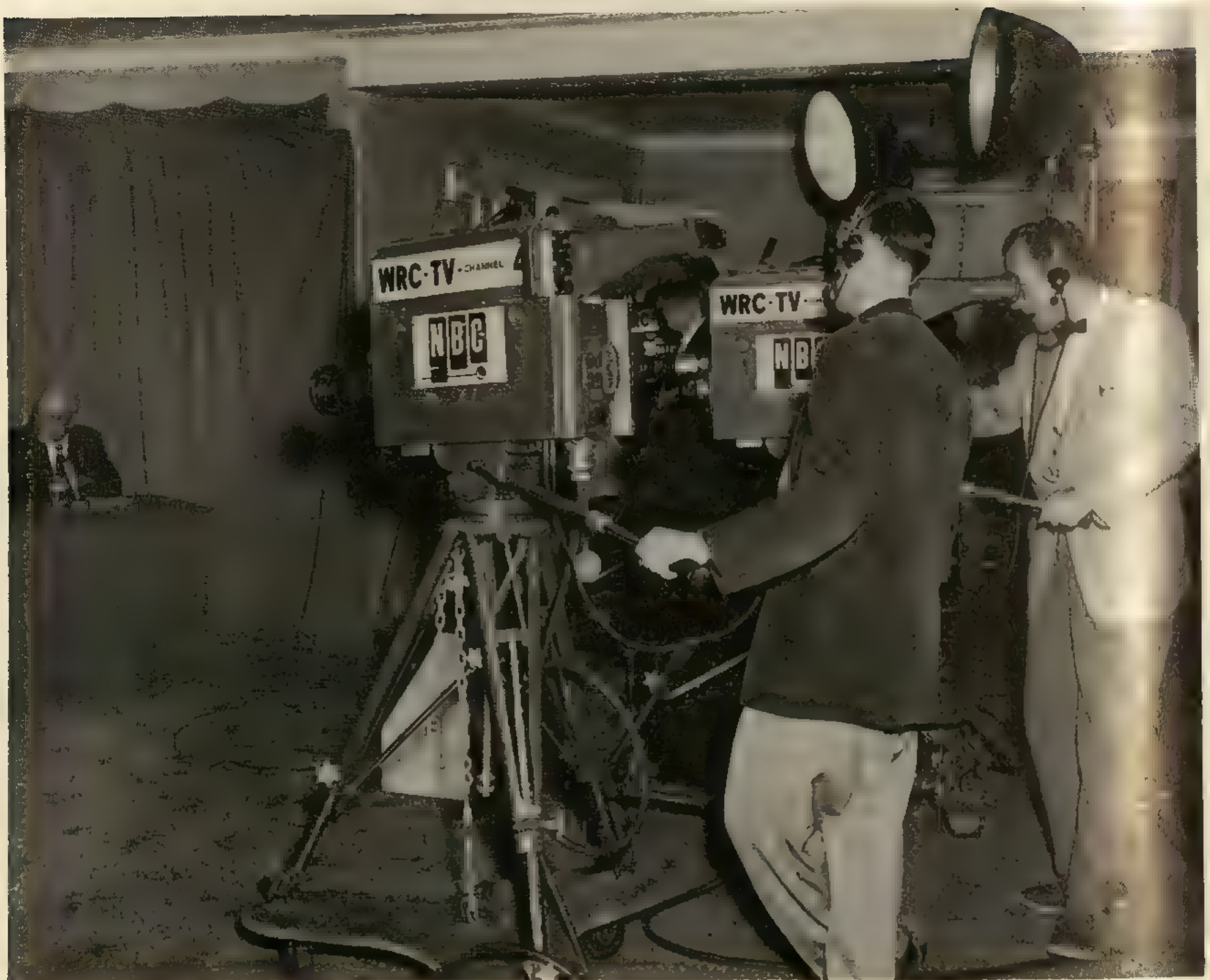
Nearly half of the television broadcasting time in 1955 was devoted to filmed programs. For filmed programs, the role of the station's programming staff is limited to preparing the film and timing and scheduling the show. Many stations employ specialized staff members to take care of filmed program material. The *film editor* edits negatives and prints of film or kinescope in accordance with program requirements. He arranges film sequences to establish continuity of action and he may also splice them together. The *film librarian* catalogs and maintains the station's files of motion picture film, which include not only complete programs, but a great many short sequences that can be fitted into programs to create effects, such as outdoor action, which are difficult to produce in the studio.

Engineering Department. The engineering department of a broadcasting station is responsible for converting the sounds and pictures that make up the programs into electronic impulses that can be received on home radio and television sets. Placing microphones, adjusting levels of sound, keeping transmitters operating properly, moving and adjusting television cameras to produce clear, well-composed pictures, lighting television scenes and performers are the main tasks of the engineering staff. They also install, maintain, and repair the many types of electrical and electronic equipment that are required for these operations.

The basic job in the engineering department is that of the *broadcasting technician.* The major function of the technician is to control the operation of the transmitter to keep the output level and frequency of the outgoing broadcast within legal specifications. He also sets up and maintains equipment in the studio and in locations from which remote broadcasts are to be made. (Information on the duties, training, employment outlook, earnings, and working conditions of broadcasting technicians is given later in this chapter.)

Stations with more than 1 or 2 technicians generally employ *a chief engineer*, who assumes responsibility for all engineering matters. In the smaller stations, he may also work a regular shift at the control board. The larger stations have engineers who specialize in such fields as sound recording, motion picture projection, television cameras, and lighting. A small number of *development engineers* work in the very large stations, designing and developing new electronics apparatus to meet the special problems of the station. Other specialized personnel in the engineering department include *cameramen*, *lighting engineers*, and *microphone boom operators*.

Sales Department. Broadcasting stations earn their income by selling services to advertisers and agencies. These services consist of time on the air which is allotted to the advertiser's message to the listening or viewing audience. Such announcements, commonly called "commercials," are inserted at specified intervals during programs in accordance with Federal Communications Com-



PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Television cameman operating cameras during telecast of discussion program.

mission regulations and industry standards. Advertisers may buy time as part of a regular daily or weekly show with which they wish to identify their product, or they may simply buy a time segment or "spot" without special reference to the program being broadcast.

Time salesmen, the largest group of workers in this department, sell time on the air to sponsors, advertising agencies, and other buyers. They must have a thorough knowledge of the station's operations and the characteristics of the area it serves that are of most interest to advertisers, such as population, number of radio and television sets in use, income levels, and consumption patterns. Time salesmen in larger stations often create and maintain a close relationship with particular sponsors and advertising agencies, selling time and acting as a general consultant and advisor to these clients in matters pertaining to advertising through the station. In very small stations, the time salesman may also handle other functions as well as selling. Many stations sell a substantial part of their time through independent sales agencies known as station representatives, which act as intermediaries between time buyers and stations or groups of stations.

Large stations generally have a large staff of workers who do only sales work. The *sales manager* supervises his staff of time salesmen, directing their efforts and setting general sales policy. He may also handle a few of the largest accounts personally. Some large stations employ *statisticians* or *statistical clerks* to assist the sales staff by analyzing and reporting the market data relating to the community served, the significance of the ratings of the station's programs reported by the rat-

ing services, and other types of statistical information.

Business Management. Like other businesses, broadcasting stations perform a considerable amount of administrative work. In a very small station, the owner and his secretary may handle all the recordkeeping, accounting, purchasing, hiring, and other routine office work. In the larger stations, executives such as station managers have wide responsibilities which vary with the size and scale of operations of the station. Where the size of the station warrants the employment of full-time specialists, the business staff may include accountants, lawyers, personnel workers, and other professional workers. They are assisted by such office workers as stenographers, typists, bookkeepers, clerks, and messengers. Building maintenance men are employed in the large stations to keep the facilities in good repair.

Training, Other Qualifications, and Advancement

Most of the skilled jobs in broadcasting stations are held by persons who started out in low-level entry jobs and acquired their knowledge and skills over a period of years, moving up to successively more responsible jobs. Smaller stations usually hire young people with at least high school, and preferably some college education, for beginning jobs. Some broadcasting employees have had training in technical schools which offer courses preparing young people for various radio and television broadcasting jobs.

Generally, no specific types of training or previous experience are required for broadcasting jobs, except where the worker must operate the transmitter. Because of legal requirements, anyone who does this work must hold an FCC radiotelephone license. Regardless of which specific career field a person is interested in, whether announcing, engineering, sales, or writing, he will find it much easier to obtain a beginning job in a small station if he has this license. Stations with only a few employees prefer to have as many of them as possible legally qualified to operate the control board and transmitter. A course in electronics at a good technical institute is probably the best way of preparing for the FCC test one must pass to obtain the license.

Small stations generally use their personnel in "combination" jobs whose functions cross the lines of the departments found in the larger stations. Though small stations cannot pay high salaries, the fact that they offer a new worker the opportunity to learn all the different phases of broadcasting work makes them a good place to begin a career.

Some higher level positions in larger stations are filled by persons who have had experience in smaller stations. However, large stations fill most job openings by hiring new workers for lower level entry jobs and by promoting them to more responsible jobs as they gain knowledge and experience. New people are commonly hired as clerks, typists, pages, messengers, or assistants of various sorts. Persons hired for beginning jobs are usually selected on the basis of their potentialities for learning and for handling the higher level jobs eventually rather than for any specific experience or training. A common way to get started in broadcasting is to take a temporary summer job when workers go on vacation and daylight-hours stations work longer hours. Many stations recruit new workers by first trying them out in temporary summer jobs.

Young people who are interested in broadcasting work will want to know what kinds of transfers and promotions are possible after they have obtained an entry job in a station. In general, people in the engineering department tend to remain in this area of work, where thorough training in electronics is essential. Program employees also tend to stay in one department, though transfers from and to the sales and business services departments are made occasionally. There is easier transferability between sales and administrative jobs because they are often merged in one department in the smaller stations.

Although transfers of skilled persons between departments are limited to the extent noted, these distinctions are less important in the beginning jobs and also in the top level jobs. Young people hired as typists or page boys, for example, are able to move into program jobs as well as sales and administrative jobs. At the upper end, a station executive may be drawn from top level personnel of any of the departments.

Employment Outlook

A continued increase in employment in broadcasting occupations is expected during the late 1950's and the 1960's. The rate of growth in

these occupations will be somewhat greater than the expected growth in the labor force as a whole. Employment in television stations will increase as a result of the opening of new television stations and the expansion of program originating facilities in the larger stations and networks. Radio employment will expand moderately as some new stations are opened and staffs of existing stations are expanded. In addition to job opportunities created by the industry's growth, many openings will arise when workers in the industry leave their jobs because of death, retirement, or transfers to other fields of work. Deaths and retirements alone will provide from 1,000 to 1,500 openings each year.

From 1920, when the first daily radio broadcasts were started, until the beginning of World War II, broadcasting employment increased slowly and steadily. After the war, radio experienced a very rapid growth, with the number of radio stations more than doubling between 1945 and 1949. Since then, radio has continued to grow, but at a much slower rate.

In 1947 and 1948, television began to come into prominence as a new broadcasting medium. From 1947 until 1951, the number of television stations increased from 7 to 107. Although this growth was extremely rapid, its impact on total broadcasting employment was not very great because television still made up only a small part of the broadcasting industry. During the "freeze" on authorizing new television stations, which lasted from early in 1950 until late in 1953, new stations were not added. However, employment continued to grow, as the existing stations expanded their staffs. After the freeze was lifted, new stations came on the air at an unprecedented rate. By 1956, more than 450 commercial television stations were in operation.

The expansion in both the radio and television broadcasting activity more than doubled the industry's employment in the period from 1946 to 1956. Because radio grew rapidly early in the decade, and television had its fastest growth in the latter half of the decade, overall employment grew at a rather steady rate over the entire period.

In the decade 1956 to 1966, probably from 300 to 400 new television stations and several hundred radio stations will be put into operation. Since most of these will be small, the employment increase will be much less than that in the past decade. Stations already in operation will also experience some expansion as television programming facilities and other radio and television services are improved and expanded as a result of the population growth of the communities in which they are located. These changes will probably increase employment more rapidly in the late 1950's and the early 1960's.

Employment in broadcasting over the next decade or two may be affected somewhat by the switch to color television, possible changes in the pattern of channel allocations, and the trends in the use of filmed or taped television programs. The impact of each of these developments on employment is difficult to predict because of the highly competitive nature of this industry and the lack of any clear trends in the recent past. Color television will probably come into widespread use within the next decade. Although the exact timing of this development cannot be predicted, it is expected that, with the exception of some programming and technical jobs in the network centers, color television will have little effect on total broadcasting employment. The pattern of station allocations in effect in 1956 has been considered a limitation in allowing the national television system to grow as large as it might on a purely economic basis. If the Federal Communications Commission should make changes in this pattern, the opening of some new stations in the large metropolitan areas might be hastened. On the other hand, a pronounced swing to the use of filmed or taped shows could reduce the need for new workers in the networks and large stations.

Earnings and Working Conditions

Earnings of broadcasting workers range from $40 a week for beginning clerical workers in small stations to more than $10,000 a year for established and highly skilled announcers, chief engineers, directors, and time salesmen in the larger stations. Employees in larger stations generally earn considerably more than workers in the same types of jobs in smaller stations and in smaller communities. Persons who work in the network stations generally have the highest earnings.

Working conditions in broadcasting stations are usually very pleasant. Except for remote pickups, the work is done indoors in clean, attractive surroundings. Jobs in programming are particularly attractive because of the glamour attached

to success in this field and the opportunities it affords for artistic expression.

Most broadcasting employees have a scheduled 40-hour workweek. Sales and business services workers generally work in the daytime hours common to most office jobs. However, program and engineering employees must work shifts which may include evenings, nights, and weekends. Some employees work 42-, 44-, and 48-hour weeks regularly, receiving overtime pay for the extra hours.

Many unions operate in the broadcasting field. They are most active in the network centers and the larger stations. The National Association of Broadcast Employees and Technicians organizes all kinds of broadcasting workers. Engineering department employees of many stations are members of the International Brotherhood of Electrical Workers. The International Alliance of Theatrical Stage Employees and Moving Picture Machine Operators organizes various crafts such as stagehands, sound and lighting technicians, wardrobe attendants, makeup men, and cameramen. Entertainers, most of whom are not staff employees, are usually members of the American Federation of Television and Radio Artists.

Radio and Television Announcers

(D. O. T. 0–69.21)

Nature of Work

About 10,000 staff announcers were employed in radio and television broadcasting stations in mid-1956. They announce news and commercial messages, give station identifications, describe sporting events, and introduce programs. In the small stations, they may perform additional duties such as operating the control board or transmitter, or selling time. Staff announcers in the larger stations have more specialized duties confined to the program department. In addition to announcing, they may act as masters of ceremonies, conduct interviews, and participate in other ways in locally originated shows.

Many announcers act as "disc jockeys," introducing selections of recorded music and commenting on the music and other matters of interest to the audience. Disc jockeys must "ad lib" much of their commentary, working without a detailed script. A few hundred highly paid announcers work in the network centers as "free lancers," selling their services to the stations for a fixed period on a contract basis.

Training, Other Qualifications, and Advancement

Announcing is a job in which personal characteristics are very important. To succeed in radio, one must have a pleasant, well-controlled voice; in television, rather high standards of personal appearance must also be met. A person who is considering a career as an announcer should therefore realistically evaluate his own personal characteristics. If one's voice or general appearance does not create a pleasant impression, he will be handicapped as an announcer. Because of the ever changing nature of the work, an announcer must be able to think fast and handle unusual situations effectively. Most announcers are men, but there is a trend toward employing more women announcers, especially in television, where their appearance is an asset. An announcer must have a thorough knowledge of English grammar and usage. A broad educational background is also very helpful.

Many announcers get their first jobs in small stations, where they are frequently required to perform a number of other program duties, such as writing script and news copy, or making sound effects. In addition, small-station announcers sometimes handle work outside the program department, such as operating controls or selling time. For this reason, prospective announcers often obtain an FCC first-class radiotelephone license, which makes them legally eligible to operate the transmitter and therefore of much more value to a small station. In the larger stations, it is sometimes possible for young persons to start out as clerks, messengers, or page boys and gradually work into announcers' jobs. A number of schools offer training in radio and television announcing.

Many announcers work in several different stations in the course of their career. After acquiring experience in a small station, an ambitious and talented announcer may move to a better paying job with a larger station. He may then improve his status by working into a regular program as a disc jockey. Some of the more successful an-

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nouncers become well known and highly paid personalities in the large stations.

Employment Outlook

Employment of announcers will increase fairly rapidly in the late 1950's and the 1960's as new radio and television stations are opened. It is expected that from 300 to 400 new television stations and several hundred radio stations will go on the air during the 1956 to 1966 decade. Additional television announcers may also be required in existing stations when they extend their broadcasting schedules into morning and afternoon hours. Some job openings in this small occupation will also result from deaths, retirements, and transfers to other fields of work rather than the increase in number of jobs. The growth of the industry and replacement needs together will create, on the average, about 400 to 500 openings for announcers each year in the coming decade. It will probably be easier to get a beginning job in radio than in television because of the greater number of radio stations, especially small stations which hire beginners. However, the great attraction of this field and its relatively small size will result in keen competition for availabe jobs.

Earnings and Working Conditions

Earnings of individual announcers depend considerably on the size and location of the station and the extent of special fees and commissions they receive. Announcers in small stations are generally paid a fixed weekly or monthly salary. In mid-1956, most announcers in small stations were earning from $60 to $75 per week. In medium-size stations, earnings generally ranged from $80 to $110. Many established announcers in large metropolitan stations were earning more than $150 per week. Included in the earnings of many better paid announcers are fees received from advertisers which augment the salary received by the announcer from the station. Announcers who are able to work into regular positions on the station's shows, as for example, well-known disc jockeys or announcers who become identified with popular network radio or television programs, earn considerably more than salaried announcers. In medium and large communities, some of these announcers earn more than $10,000 a year.

Announcers often work evenings, nights, and weekends. Their work hours consist of both time on the air and time spent in preparing for broadcasts, and vary from job to job. In stations with very small staffs, announcers generally work regular shifts and also perform other duties. Working conditions for announcers are generally very pleasant owing to the variety of the work and the many personal contacts which are part of the job. Announcers also receive some satisfaction from having their names become well known in the community.

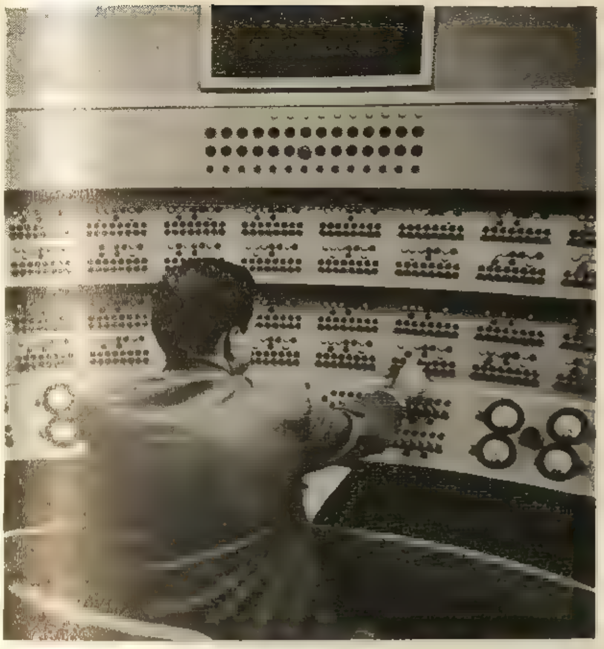
Broadcasting Technicians

(D. O. T. 0–66.00 through 0–66.09)

Nature of Work

Technicians in broadcasting stations service the electronic equipment which picks up the sounds and pictures in the studio and puts them on the air. These workers, who may be called broadcast, transmitter, studio, maintenance, or recording technicians, operate the transmitters, maintain and operate the electronic equipment in the studio, and set up equipment for remote pickups. Operating the transmitter involves monitoring and adjusting the output levels and frequency of the outgoing broadcast. Though operating this equipment does not in itself require much electronics knowledge, the legal licensing requirements and the usual practice of having these men perform electronics maintenance work around the station make it necessary for them to have thorough training in electronics to hold their jobs.

The job of the broadcasting technician which requires the most technical knowledge is that of setting up, maintaining, and repairing the intricate electronic equipment in the station. Picking up the sounds and pictures in the broadcasting stations, converting them into electrical impulses, and getting the signal to the transmitters is done by means of microphones, video cameras, cables, and other electronic transmission and amplification equipment. When trouble develops in any of this equipment, the technician must repair it and put it back into operation.



Broadcasting technician operating main radio control board of network station.

Technicians must go to the site of the pickup and set up the necessary equipment when events taking place outside the studios are to be broadcast. They test the equipment after it is installed and then stand by to make any emergency repairs. After the broadcast, they dismantle the equipment and return to the station. Other functions of broadcasting technicians are operating and maintaining sound-recording equipment and motion-picture projection equipment.

About 13,000 broadcasting technicians were employed in radio and television stations in mid-1956. More than half of the broadcasting stations were small enterprises employing from 2 to 4 technicians. However, the larger stations in the large metropolitan areas employ the majority of broadcasting technicians. The highest paying and more specialized jobs are concentrated in New York and Los Angeles, the originating centers for most of the network programs.

Training, Other Qualifications, and Advancement

A young man interested in becoming a broadcasting technician should plan on getting a first-class radiotelephone license from the Federal Communications Commission. Federal law requires that any person who operates or maintains broadcast transmitters must have a license. Applicants for licenses must pass a written examination covering the construction and operation of transmission and receiving equipment, the characteristics of electromagnetic waves, and Government and international regulations and practices governing broadcasting. Information about these examinations and guides to studying for them may be obtained from the Federal Communications Commission, Washington 25, D. C.

Perhaps the best way to acquire the knowledge necessary for becoming a broadcasting technician is to take an electronics course in a good technical school. Most of the better schools provide courses especially designed to prepare the student for the FCC test and to qualify him for a beginning job in a broadcasting station.

Young men with FCC licenses who are hired into entry jobs at larger stations are instructed and advised by the chief engineer or other experienced technicians in the work procedures of the station. In small stations, they may start operating the transmitter and handling other technical duties after a brief orientation. As they acquire more experience and skill, they are assigned to more responsible projects, such as repairing complex equipment. Men who demonstrate above average ability may move into the top level technical positions as senior technicians or chief engineers.

Employment Outlook

Employment of broadcasting technicians will increase fairly rapidly in the late 1950's and 1960's. The 300 to 400 new television stations and the several hundred new radio stations which are expected to go on the air during the 1956 to 1966 decade will create many additional jobs for technicians. Many existing stations will also increase their employment of technicians as they expand their broadcasting schedules; most of the job openings in these stations will result from deaths, retirements, and transfers to other jobs.

Color television will probably become the more common form of television during the next decade. As a result, most stations will have to make some changes and additions to their cameras and other pickup and transmitting equipment. Color television equipment is more complicated than black and white, and will probably require more maintenance in its first few years of use. Originating a color show will require some additional technical work in the lighting and photographing

of the various scenes and actions. These developments will moderately increase the need for technicians. On the other hand, it is possible that there may be some decline in the need for technicians in radio stations as a result of changes in Federal regulations governing transmitters. Some of the new equipment now being introduced is more reliable and self-regulating and may make it less necessary to have a licensed man to monitor all transmissions.

Earnings and Working Conditions

Broadcasting technicians are a relatively well-paid group of skilled workers. Their earnings vary greatly with the size of the station. Beginning salaries for technicians ranged from about $50 to $75 a week in the smaller stations in mid-1956. Experienced men earned from about $80 a week in small towns to more than $150 in the large cities. Some technicians in the network originating stations earned more than $165 a week.

Most technicians in the larger stations have a 40-hour week, with overtime pay rates for more than 40 hours. In small stations, it is common for technicians to work 2, 4, or 8 hours of overtime each week on a regular basis. Evening, night, and weekend work is very common since many stations are on the air as many as 24 hours a day.

Broadcasting technicians generally work indoors in pleasant surroundings. The work is interesting, and there is often considerable variety of work duties, especially in the larger stations. When remote pickups are made, technicians may work out of doors at some distance from the studios.

OCCUPATIONS IN THE RAILROAD INDUSTRY

The Railroad Industry and Its Workers

The railroad industry is one of the Nation's largest employers. More than 1 million workers were employed in 1956 to operate trains, serve passengers, maintain and repair equipment, and carry on the hundreds of activities required to run the industry. The railroad industry served almost every part of the country over a huge network of 220,000 miles of track and carried half of the freight and over one-third of the passengers transported by all intercity carriers in 1956.

Lifetime careers in a variety of interesting occupations are offered by the Nation's railroads. Regardless of the occupation they enter, however, new workers must expect to start at the bottom of the ladder and work up slowly as they prove their ability and acquire seniority.

Nature and Location of the Industry

The railroad industry in 1956 was made up of more than 400 line-haul railways—those engaged in transporting freight and passengers between cities and towns—and over 200 companies which operated switching and terminal facilities. These firms operated more than 30,000 locomotives, 35,000 passenger cars, and 2 million freight cars, and transported nearly 1.5 billion tons of freight and 430 million passengers in 1956.

The large, well-known railroads are all in the group technically known as class I line-haul railways. In 1956, the more than 100 companies in this category operated about 95 percent of the total mileage of all line-haul railways. They employed nearly 95 percent of all railroad workers, and hauled more than 99 percent of all railroad freight and passenger traffic.

In addition to the class I railways, there are two other groups of railroad companies: small line-haul railways not included in class I, and switching and terminal companies. Although there were more than 300 small line-haul companies operating in 1956, they employed only about 1 percent of the workers in the industry. The more than 200 switching and terminal companies—which perform bridge and ferry service or switching and terminal service at stations, stockyards, and other terminal points—employed 50,000 workers in 1956, or about 4 percent of all railroad workers. Other employers in the industry are the Railway Express Agency and the Pullman Co.

The traveling public is most familiar with the passenger part of the railroad business; however, freight service brings in far more revenue than passenger service. In 1956, 85 percent of all class I railroad revenue was derived from freight, and only 7 percent from passenger traffic. The remaining revenue came from mail, express, and various other sources. The largest sources of freight revenue came from the hauling of coal, lumber, iron and steel, wheat, and vehicle parts.

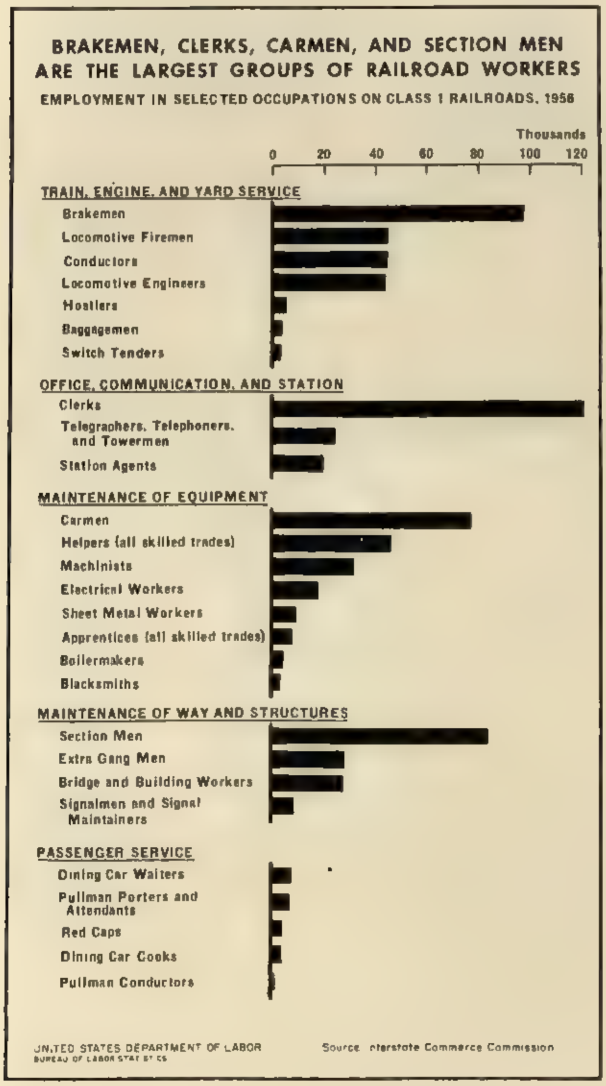
The railroad industry serves every part of the Nation and, consequently, the stations, yards, switch towers, and other railroad facilities and the workers who operate them are located all over the country. Chicago, where the great eastern and western systems meet, is the hub of the Nation's railroad network. Chicago also has the largest concentration of railroad workers. Large numbers of railroad workers are also employed in New York, Pittsburgh, Philadelphia, Los Angeles, St. Louis, and Cleveland. In 1956, nearly one-fifth of all railroad workers were employed in the metropolitan areas of these 7 cities. Concentrations of railroad workers are also found in some of the smaller cities which have large locomotive and car shops. Hollidaysburg, Pa., and Huntington, W. Va., for example, have a large number of railroad employees although they are relatively small cities.

The States with the largest number of railroad workers are Illinois, Pennsylvania, New York, Ohio, California, Texas, Missouri, Minnesota, and Indiana. More than half of all the railroad workers in the United States were located in these 9 States in 1956. Illinois, with about 108,000 workers in 1956, is the leading railroad State. However, railroad workers are found in all States; even Rhode Island, the State with the fewest workers, had about 1,500.

Railroad Occupations

The railroad industry's workforce is made up of five main groups—those who (1) operate the trains, (2) perform the communication, station, and office work, (3) build and maintain the rolling stock, (4) maintain the tracks, structures, and other railroad property, and (5) prepare and serve food and provide other services to passengers on trains. Chart 64 shows the number of employees in some of the more important railroad occupations. Other railroad occupations, not listed in the chart, range from professional positions requiring college degrees, such as accountants, engineers, and statisticians, to unskilled laundry and cleaning jobs.

CHART 64



Workers directly concerned with the operation of trains are the locomotive firemen, locomotive engineers, brakemen, conductors, train baggagemen, hostlers, and switch tenders. More than 250,000 men were employed in these occupations in 1956. The engineer and the fireman make up the engine crew which drives the locomotive. The engine crew works in close contact with the train crew, which includes the conductor, several brakemen, and on some trains, a baggageman. Hostlers service locomotives at terminal points and prepare them for use by the engine crew. Switch tenders are stationed at strategic points in the yards to throw track switches.

Communication, station, and office employees numbered over 300,000 in 1956. Communications are handled by telegraphers, telephoners, and towermen who coordinate the movement of trains by receiving train orders and passing them on to train crews. The station agent takes care of the railroad's business at his particular station. Clerks sell tickets, tend the baggage room, keep records, deal with customers, and perform related tasks in stations and company offices. Clerical jobs are the only railroad positions in which women are employed to any great extent; about one-fifth of the clerks are women. The large railroads have staffs of lawyers, engineers, accountants, and investigators.

More than 260,000 workers were employed in railroad carshops and engine houses to maintain and repair locomotives and cars. Carmen keep railroad freight and passenger cars in good operating condition, performing a variety of repair and maintenance tasks. Electrical workers, machinists, boilermakers, blacksmiths, and sheet metal workers are also employed in the shops, each contributing his particular skill to the maintenance of the rolling stock.

In 1956, more than 180,000 workers were employed to maintain tracks, bridges, stations, signals, and other railroad property. Trackmen construct, maintain, and repair tracks and roadways. Bridge and building mechanics construct and maintain bridges, tunnels, water tanks, and many other structures. Signal workers are responsible for the efficient operation of the railroads' vast network of signals.

Nearly 23,000 employees were engaged in providing services to passengers aboard trains in 1956. Pullman conductors collect sleeping-car and parlor-car tickets and supervise the porters

and attendants who perform many personal services for passengers. Dining car cooks and waiters prepare and serve food on dining cars and club cars. Redcaps handle baggage for passengers in and around railroad stations and assist passengers in boarding and leaving trains.

Some of the more important occupations in the railroad industry are discussed in detail at the end of this chapter.

Training, Other Qualifications, and Advancement

Training for most railroad occupations is received on the job. Inexperienced workers are hired in entry jobs and learn the more skilled jobs while working with experienced men. Apprenticeship training is given only in the shop trades and in some maintenance-of-way occupations. These apprenticeship programs give a young man thorough and systematic training and experience in all aspects of his chosen trade. Most apprenticeship programs last 4 years.

Railroad companies prefer applicants who have a high school education or its equivalent for most occupations. Good physical condition is a requisite for most jobs and, in many cases, applicants must pass physical examinations before they are hired. The standards for hearing and eyesight are particularly strict for train and engine service jobs, since good eyesight and hearing are essential for safety. Color blindness is an absolute bar to employment in any type of work involving interpretation of signals.

In most operating jobs new employees begin work by being placed on the "extra board," which is a list of workers in each particular occupation who are given temporary assignments as men are needed. As openings arise and as these extra workers gain seniority and experience, they are advanced to regular positions. The amount of time spent on extra board work varies with the type of job and the number of available openings. Some workers may spend only a few months on extra work, whereas other workers may not receive regular assignments for a number of years.

Promotions of qualified workers to higher positions are made on the basis of seniority. As vacancies occur within a particular field, they are listed on a bulletin board. All workers who are interested may "bid" for the job, which goes to the qualified applicant who is highest on the seniority list. Before workers can qualify for promotion, they often must pass written and practical tests. In many railroad positions, there are established avenues of promotion; for example, engineers are always chosen from the ranks of the firemen, and conductors from among the brakemen.

Railroad workers usually do not have seniority rights over an entire railroad system, but only within a seniority district specified in the union contract. Among train and engine personnel, seniority rights are usually limited to either freight and passenger service or yard service, and workers may bid only for positions in their particular type of service. In some cases, seniority rights may extend over only one shop, locality, or office.

(See later sections in this chapter for a more complete discussion of the training and other qualifications for individual occupations in the railroad industry.)

Employment Outlook

Thousands of new workers will be hired by the Nation's railroads during the late 1950's and the 1960's even though railroad employment is expected to decline during this period. The railroads have one of the largest and oldest work forces in American industry, and vacancies resulting from deaths, retirements, and transfers to other fields of work will provide thousands of job opportunities for new workers each year.

Employment has shown a long-term downward trend since 1923, when nearly 2 million persons were employed on the Nation's railroads. During the 1930's depressed business conditions brought about a severe decline in railroad business, and employment fell to about 1 million. During World War II, the railroads expanded their services tremendously to transport great quantities of the freight and passenger traffic essential to the war effort, and employment reached almost 1.5 million in 1945.

In the 1946–56 decade, competition from other freight and passenger carriers and the introduction of better railroad equipment and facilities resulted in declining employment. Although common carrier freight traffic increased nearly 25 percent, the railroads' share of this traffic declined. The actual amount of freight hauled by the railroads increased slightly over the decade, but the proportion of common carrier freight

carried by the railroads declined from nearly 70 percent in 1946 to only 50 percent in 1955. This decline resulted from the fact that most of the new traffic that developed in the postwar period was carried by motor trucks, oil pipelines, and water carriers. Motor trucks made the most impressive gains, particularly in short-haul traffic, increasing their share of all freight transported from 9 percent of the total to nearly 20 percent. Pipelines built during the 1940's and the early 1950's transported an increasing volume of petroleum products, which were formerly hauled almost exclusively by railroad tank cars.

Passenger traffic carried by the railroads declined drastically in the postwar decade. From 1946 to 1955, intercity passenger traffic transported by all types of common carriers, such as railroads, buses, and air carriers, decreased over 20 percent, primarily as a result of the increased use of private automobiles. The impact of this decline fell almost entirely on the railroad industry, whose passenger traffic dropped from 65 billion passenger miles in 1946 to less than 29 billion passenger miles in 1955. In 1946, the railroads had over 60 percent of passenger business; by 1955 the industry's share of this business dropped to 36 percent. The only increase in passenger traffic was experienced by the airlines, which made tremendous gains during this period, increasing their traffic from 6 billion to 23 billion passenger miles. Passenger traffic carried by buses and other intercity common carriers remained relatively stable over the decade. The loss of long distance traffic to the airlines and short distance traffic to buses has been a major factor in the decline in railroad passenger traffic.

As railroad passenger traffic declined and freight traffic remained relatively stable, average employment in the industry fell from 1.4 million in 1946 to slightly over 1 million in 1956. Increased mechanization of the railroads was the principal factor in this decline in employment. A reduction in labor requirements was the result of many improvements in railroad equipment and methods of operation. The introduction of diesel locomotives capable of hauling longer trains at higher speeds with less maintenance than steam locomotives has been a factor in reducing employment in both shop and operating occupations. Power equipment, introduced into maintenance-of-way work, has greatly reduced the amount of labor required in this work. Communication and signal systems were modernized and most manually operated signals were replaced by automatic devices. Accounting and bookkeeping procedures were also improved and data-processing machines were introduced.

During the late 1950's and the 1960's the Nation's total freight traffic is expected to rise considerably as a result of the anticipated increase in industrial production and general economic expansion. As a result, the amount of freight carried by the railroads is expected to increase. Although the railroads' share of total freight traffic has declined steadily from 1946 to 1956, it is expected that there will be little further decline in the next decade and railroads will probably continue to carry the major share of total freight traffic.

The railroads' share of passenger traffic, which has been declining in recent years, is expected to continue to decrease during the late 1950's and the 1960's. Air carriers will probably attract more long-distance travel while buses will compete for short-distance coach traffic.

On the basis of anticipated volumes of freight and passenger traffic and the expected continuation of mechanization, a slow decline in employment is indicated in the railroad industry in the late 1950's and the 1960's. There are several technological factors which are expected to result in future decreasing manpower needs. For example, the greater use of centralized traffic control systems, which enable an operator to control track switches and signals over a large area from a central station, will reduce the need for switch tenders, telegraphers, telephoners, and towermen. Highly mechanized classification yards, in which routings of cars are handled electronically, will also reduce the need for many of the workers now engaged in making up and breaking up trains and classifying cars. The increasing use of television, which enables an observer to supervise freight yards more efficiently and to obtain information on cars before they reach the yards so that they can be classified faster, will also contribute to the decline in railroad employment. The addition of more diesel locomotives is expected to bring about further declines in employment in the maintenance fields, since diesel engines not only require fewer repairs, but place less strain on tracks and roadways. The increased use of power equipment in maintenance-of-way work will also tend to reduce

maintenance employment. The large scale use of electronic data processing machines is expected to bring about a reduction in the employment of clerical workers.

As noted previously, despite declining employment, replacement needs in this large industry make it an important area of job opportunities for new workers. Just to replace the workers who die or retire would create about 250,000 job openings during the 1956–66 decade.

Earnings and Working Conditions

Average earnings of railroad workers are generally higher than those of workers in manufacturing industries. In December 1956, employees of class I railroads, exclusive of executives and administrative personnel, had average hourly earnings of $2.21 and average weekly earnings of $90.61. In the same month, production workers in all manufacturing industries averaged $2.[illegible] an hour and $84.05 a week.

Because of the great variety of occupations and skill requirements in the railroad industry, earnings in individual occupations vary widely. Earnings depend not only upon the degree of skill and experience required to perform a job satisfactorily, but also on the amount of responsibility involved. For example, the locomotive engineer, in whose hands rests the safety of passengers, freight, and millions of dollars' worth of railroad equipment, has considerably higher earnings than workers with less responsibility. Workers on the extra board usually earn less than men with regular assignments, since they often work less than the full workweek. Earnings in selected railroad occupations are included in later sections of this chapter.

Work schedules of railroad employees depend upon the type of service in which they are employed. The rules governing the workday for train and engine crews in road, freight, and passenger service are extremely complex. Generally, when a member of the train or engine crew has "run" a specified number of miles, or worked a certain number of hours—whichever occurs first—he is considered to have completed a "basic day's work." Additional pay is given for any extra work whether in miles run or hours worked.

Employees directly concerned with serving passengers aboard trains—pullman conductors, dining car cooks and waiters, pullman porters, and other train attendants—had a basic 205-hour month in 1956. Pullman conductors received time and one-half pay for hours worked beyond 215 a month, and the other workers received time and one-half for hours worked over 240 a month. Men with regular assignments were guaranteed at least 205 hours of work a month.

Yard workers generally worked 8 hours, 5 days a week with time and one-half paid for hours worked over 8 in any 24-hour period. Railroad workers not directly concerned with the operation of the trains, such as maintenance and office employees, also worked a 40-hour week in 1956, and usually received premium pay for overtime.

Because freight shippers and the traveling public must be served 24 hours a day, engineers, firemen, brakemen, conductors, hostlers, telegraphers and telephoners, station agents, and other railroad employees are often required to work nights and weekends. Irregular work schedules are particularly common for extra board workers, since they have no permanent assignment and are on call at any time of day or night. Some railroad workers are required to work away from home for days at a time.

Railroad workers are covered by the federally administered Railroad Retirement Act and Railroad Unemployment Insurance Act. Retirement benefits are financed jointly by employers and employees; unemployment benefits are paid for solely by the employers. All railroad employees become eligible to retire on a full pension when they reach 65 years of age. Men with 30 years of service may retire on a partial pension at age 60. Disabled employees receive annuities and the survivors of insured workers are paid death benefits or annuities. The average monthly pension paid retired railroad workers was about $110 in the 1954–55 period, which was more than the average amount received by workers retiring under the Social Security System.

Unemployed railroad workers receive higher unemployment compensation than that received by workers covered by most State unemployment compensation laws. Railroad workers receive the same compensation for work days lost due to sickness or injury as they do for unemployment.

Disabling injuries occur more frequently among railroad employees than among manufacturing

workers in general. In 1955, the injury frequency rate per million man hours worked was 13.9 in the railroad industry, and 12.1 in manufacturing.

Most employees receive a 1-week paid vacation after 1 year on the payroll, 2 weeks after 5 years, and 3 weeks after 15 or more years of service. On many roads employees receive comprehensive hospital, surgical, and medical insurance benefits.

Most railroad workers are covered by collective bargaining agreements. They belong to unions which are organized on a craft, occupational, or departmental basis. Contracts between the unions and the railroad companies regulate wage rates, hours of work, seniority, and many other matters affecting railroad workers. The principal unions representing each occupational group are listed in the sections covering individual occupations.

Locomotive Engineers

(D. O. T. 5–41.010)

Nature of Work

The engineer is responsible for the safe and efficient operation of the locomotive. Before each run, he inspects the locomotive and checks the supply of fuel, water, sand, and other items needed for the trip. The engineer, along with other members of the train and engine crew, confers with the conductor to make certain that the train orders are understood and properly carried out. En route, he operates the throttle, air brake, and other controls. He sees that the track is clear, observes the wayside signals, and verifies the accuracy of his reading of them with the fireman. On steam engines, the engineer instructs the fireman on the proper pressure which should be maintained in the boiler. At the end of each run the engineer rechecks the engine and makes out a report on any mechanical defects which may need attention.

In 1956, about 44,000 locomotive engineers were employed by class I railroads. Nearly 19,000 of these men were operating freight trains, 18,000 were in yard work, and 7,000 were in passenger service. A few thousand engineers worked for small line-haul railways and switching and terminal companies.

Engineer at controls of diesel locomotive.

Training, Other Qualifications, and Advancement

Positions as engineers are filled by promotions of qualified firemen on a seniority basis. Before a fireman can become an engineer, however, he must take comprehensive examinations covering mechanical and electrical equipment, air brakes, fuel economy, timetables, train orders, and other operating rules. The prospective engineer must also be able to operate any locomotive in service on his road. When a fireman is promoted to engineer, he starts on the engineers' "extra board," which is a list of workers who are given temporary assignments as men are needed. It may be several years before a new engineer receives a regular assignment. Engineers may work up to supervisory positions, such as road foreman of engines.

Engineers must be able to pass the strict physical examinations required at regular intervals. If they fail to meet the physical standards at any time, they may be restricted to certain types of service, or they may be removed from service altogether.

Employment Outlook

A small number of firemen will be promoted to the job of engineer each year during the late 1950's and the 1960's even though the overall employment of locomotive engineers will be declining. The number of locomotive engineers employed by class I railroads dropped from 49,000

in 1950 to 44,000 in 1956. The anticipated decline in railroad passenger travel, the trend toward longer trains handled by a single engine, and the increased mechanization of yard work will cause a further small drop of employment in this occupation in the 1956–66 decade. However, the need to replace experienced workers who die or retire will create job opportunities, locomotive engineers being one of the oldest groups of workers in the Nation's labor force.

Earnings and Working Conditions

Engineers in road service have basic daily wage rates which vary with the weight and type of locomotive and the type of service in which they are employed. In December 1956, these rates varied from about $16.90 to $21 for engineers in local and way freight service; $16.40 to $20.50 in through freight service; and $15.50 to $17.60 in passenger service. In addition, engineers who traveled more than 100 miles or worked longer than 5 hours a day in passenger service or 8 hours a day in freight service received extra pay. Because of extra mileage on fast passenger and through freight runs and because of long hours of work on slower local and way freight runs, road engineers frequently earn much more than their basic daily rate. For example, the average monthly earnings of road engineers (including extra board men) for the month of December 1956 were $585 in through freight service, $696 in local and way freight service, and $687 in passenger service. On many roads, the amount any road engineer may earn in a month is restricted by mileage limitations agreed upon by the unions and the railroad companies. On these roads, if an engineer reaches the top mileage limit, another man may take over his assignment for the rest of the month.

Engineers in yard work had basic daily rates for a 6-day workweek which ranged from about $17.20 to $21.50 in December 1956. Yard engineers had a basic 8-hour day, and for work beyond 8 hours they were paid one and one-half times their regular hourly rates. The average monthly earnings for yard engineers in December 1956, were $539.

Engineers on extra board often work irregular hours, since they may be called to work at any time of the day or night. They are also likely to have less work and lower earnings than men with regular assignments. Engineers in road service, whether on regular assignments or extra work, are often on duty away from their home base and must pay their own living expenses.

Engineers are covered by union contracts on all major roads. Most engineers are represented by the Brotherhood of Locomotive Engineers and the Brotherhood of Locomotive Firemen and Enginemen.

Locomotive Firemen and Helpers

(D. O. T. 5–42.100)

Nature of Work

The locomotive fireman operates mechanical and electrical controls and devices to assure the continuous flow of power necessary to drive the locomotive. During the run, he keeps the diesel engine in proper working order and makes any needed repairs and adjustments. The fireman also watches for obstructions on the track and for the frequent wayside signals which indicate whether the train should proceed at full speed, slow down, or stop. While rounding curves he looks back over the train for such things as dragging equipment and hot boxes. Before beginning the run, he sees that the engine is in proper working order and checks the fuel and water supply, flagging equipment, classification markers, and tools.

About one-eighth of the locomotives in use in 1956 were steam engines using coal or oil as fuel. On a locomotive of this kind, the fireman, in addition to his other duties, maintains the proper steam pressure by regulating the flow of fuel and water.

The fireman, along with the engineer, is held responsible for the observance of operating rules and regulations, and for any accident which is due to failure to obey signals. In case the engineer should become sick or disabled, the fireman must be prepared to take over control of the locomotive immediately.

About 47,000 locomotive firemen and helpers were employed by class I railroads in 1956.

Nearly 21,000 of these men were employed on freight trains and 6,000 were working in passenger service. More than 19,000 firemen worked in the yards on switching engines, which move cars in making up and breaking up trains. In addition to firemen on class I railroads, there are a few thousand who work for smaller line-haul railways and switching and terminal companies.

Training, Other Qualifications, and Advancement

Applicants for positions as firemen must be able to pass rigid physical examinations. They must generally be between 21 and 27 years of age and have a high school education or its equivalent.

A new fireman makes several trial trips under the direction of an experienced engineer and fireman. During the training period, which lasts from several days on some roads to as long as 3 weeks on others, the fireman is instructed in the duties and responsibilities of firemen and in railroad rules and regulations.

After the applicant has satisfactorily demonstrated his ability on the trial trips and has passed examinations on railroad rules and regulations, he is placed on the firemen's "extra board," which is a list of workers who are given temporary assignments as men are needed. The new fireman usually remains on the extra board for an indefinite period of time before he obtains a regular assignment. On some roads, firemen may transfer from yard to freight to passenger service. On other roads, firemen in road and yard service are on separate seniority lists and usually remain in one type of service throughout their railroad careers.

A fireman who has the necessary skill and knowledge becomes eligible for promotion to engineer after he has passed qualifying examinations covering mechanical and electrical equipment, air brakes, fuel economy, timetables, train orders, and other operating rules and regulations. (If a fireman fails to pass these examinations after three attempts, he may be removed from service.) As engineers are needed, qualified firemen with the greatest seniority are placed on the engineers' extra board. A fireman usually has to wait at least 3 or 4 years before he has the seniority and experience necessary to bid successfully for an engineer assignment. He may then have to spend several years on the engineers' extra board, working irregularly, and may have to go back to firing again if traffic should fall off in his division.

Employment Outlook

There will be a moderate number of opportunities for new workers to obtain jobs as firemen during the late 1950's and the 1960's despite an expected decline in employment in this occupation. Job openings will arise as experienced firemen are promoted to jobs as engineers, transfer to other railroad jobs, leave railroading, die, or retire.

The number of locomotive firemen employed by class I railroads decreased from 51,000 in 1950 to 47,000 in 1956. During the late 1950's and the 1960's it is expected that the employment of firemen will continue to decline slowly. The increasing use of powerful diesel locomotives will cut down employment of firemen, since the same amount of traffic can be hauled with fewer engines and engine crews. The increasing speed with which trains can be classified in yards may also reduce the number of yard firemen needed.

Earnings and Working Conditions

Firemen employed in road services are paid basic daily wage rates which vary with the weight and type of locomotive and the type of service. In December 1956, these rates ranged from about \$15.70 to \$18.60 for firemen working in local and way freight service; \$15.30 to \$18.20 in through freight service; and \$14.50 to \$16.60 in passenger service. Firemen who traveled more than 100 miles or worked longer than 5 hours a day in passenger service or 8 hours a day in freight service, received extra pay. Because of extra mileage on fast passenger and through freight runs, and because of long hours of work on slower local and way freight runs, road firemen frequently earn more than their basic daily wage rates. For example, the average monthly earnings of firemen in freight service (including extra-board men) in December 1956, were \$563 on local and way freight trains and \$455 on through freight trains. Road passenger firemen averaged \$612 in the same month.

The amount any road fireman may earn in a month is generally restricted by "mileage limitations" agreed upon by the unions and the railroad companies. If a fireman reaches the top mileage limit, he lays off for the rest of the month while

another man takes over his assignment. Men with regular runs have the best chance of reaching the maximum mileage allowed.

Basic daily rates of pay of yard firemen employed on a 5-day-week basis ranged from about $18.50 on the lightest locomotives to about $21.80 on the heaviest locomotives in December 1956. Yard firemen have a basic 8-hour day, and they are paid one and one-half times their hourly rate for work beyond 8 hours. Yard firemen averaged $431 for December 1956.

Firemen on extra board, where newcomers start out, tend to have less work and therefore lower incomes than those with regular assignments. The amount of work also varies from one season to another on many roads.

Firemen often must work at night. Irregular hours are particularly common among men on extra board, since they are on call at all times. Road service often requires firemen to be away from their home stations overnight; on these occasions, they must pay their own living expenses.

The working conditions on diesel locomotives are better than those on the old hand-fired locomotives. On the diesel locomotives the ride is smoother and, since doors and windows can be closed, there is little dirt or noise. However, the fireman is often required to leave the engine cab and go back into the diesel units; there he must work amidst diesel fumes and extreme engine noise. In the few areas where steam locomotives are used, their open cabs subject firemen to extremes of temperature in winter and summer.

Workers in this occupation are covered by union contracts on all major roads. Most firemen are represented by the Brotherhood of Locomotive Firemen and Enginemen. Others belong to the Brotherhood of Locomotive Engineers.

Brakemen

(D. O. T. 5–38.010 and .020)

Nature of Work

Brakemen are employed in freight, passenger, and yard service. Both freight and passenger trains generally carry rear brakemen (or "flagmen"), whose main duty is to protect the rear end of trains from being run into during stops or delays by signaling with flags, flares, and other devices. Freight trains usually carry at least one other brakeman, whose work includes transmitting signals from one end of the train to the other. Freight brakemen make frequent inspections of the train, operate hand brakes, and couple and uncouple cars and air hose. Passenger brakemen, often known as trainmen, perform many of the same tasks, in addition to looking after the needs of the passengers, collecting tickets, and generally assisting the conductor. Yard brakemen (frequently called switchmen) assist in making up and breaking up trains by riding on the cars to control them as they are moved about the yard.

Brakemen make up one of the largest occupational groups in the railroad industry with nearly 102,000 employed in 1956 on class I roads. More than 55,000 of these brakemen were employed in yard service, about 40,000 in freight service, and 7,000 on passenger trains. In addition, a few thousand worked for switching and terminal companies and small line-haul railways.

Training, Other Qualifications, and Advancement

Employers prefer that applicants for brakeman positions have a high school education, or its equivalent, be at least 18 years of age (21 years on some roads), and not older than 28 or 30. They must be able to pass physical examinations which have strict eyesight and hearing requirements.

On some roads, student brakemen are given qualifying exams before beginning their on-the-job training. Beginning brakemen make several trial trips where they receive instructions from an experienced brakeman or conductor. After they have demonstrated their ability on trial trips, new brakemen start out on the "extra board," which is a list of brakemen who are given temporary assignments as men are needed. Brakemen generally must work at least a year on the extra board to learn the job thoroughly; in most cases, they spend a number of years on extra work. From the extra board they move on to regular assignments when a vacancy occurs.

Brakemen in yard work usually stay in this type of service. They may advance to the position of yard conductor. On some roads, brakemen in freight service may move into passenger work,

Brakeman applying handbrake on freight car.

which is usually considered most desirable since it is less strenuous and usually involves shorter working hours. Brakemen with sufficient seniority may bid for baggageman and conductor positions.

Conductor positions are nearly always filled by promoting qualified brakemen. To qualify as conductors, brakemen need at least several years' experience. They must also pass written and oral examinations covering such subjects as signals, timetables, brake systems, and operating rules. Promotions are made according to seniority rules as openings occur, and a man may have to wait 10 years or more for his first assignment as conductor.

Employment Outlook

Several thousand opportunities for new workers to obtain jobs as brakemen will develop each year as a result of deaths, retirements, promotions, or transfers out of the occupation even though the total number of brakemen employed by the railroad industry is expected to decline during the late 1950's and the 1960's. Despite the anticipated increase in freight traffic, a significant decline in the employment of yard brakemen is expected during the 1956–66 decade because classification yards are becoming increasingly mechanized and many new electronic devices are being used to aid in the making up and breaking up of trains. The use of longer and faster trains, new radio and telephone communications systems, and other improvements in traffic control are also expected to reduce the number of road brakemen needed to handle a given amount of traffic.

Earnings and Working Conditions

Brakemen in road service have basic daily wage rates which vary with the number of cars in the train, the type of road service, and the location of their job. In December 1956, these rates varied from about $15.60 to $17 in local and way freight service; $15.20 to $16.50 in through freight service; and $15.20 to $15.30 in passenger service. Brakemen who travel more than 100 miles on freight trains or 150 miles on passenger trains or who work longer than 8 hours in one day get extra pay. Because of extra mileage on fast passenger and through freight runs and because of long hours of work on slow local and way freight runs, road brakemen frequently earn much more than their basic daily rates. For example, the average monthly earnings of road passenger brakemen in December 1956 were $518. Brakemen on through freight trains averaged $429 and those employed on local and way freight trains averaged $526 in the same month.

Brakemen in yard service have a basic 8-hour day, and for work beyond 8 hours, they are paid one and one-half times their regular hourly rate. Yard brakemen averaged $392 for the month of December 1956.

Newer brakemen who are on the extra board tend to have lower earnings than men with regular assignments, and they may also work irregular hours. Like other members of train and engine crews, all brakemen pay their own living expenses while on duty away from their home base.

Yard and freight brakemen face considerably more accident risks than most other railroad workers. Injuries are less common among passenger brakemen.

The great majority of brakemen are represented by the Brotherhood of Railroad Trainmen. However, the Order of Railway Conductors and Brakemen has organized freight and passenger brakemen on a few roads, and the Switchmen's Union of North America has organized some yard brakemen.

Conductors

(D. O. T. 0–92.00 through .29)

Nature of Work

Railroad conductors act as "captains" of trains. They are responsible for the safety of the cargo and passengers, for carrying out all orders regarding the operation of the train, and for the work of all members of the crew. Before the train leaves the terminal, the conductor makes certain that it has been thoroughly inspected and that all members of the crew understand the train orders. He also prepares detailed reports on the numbers and contents of the cars, times of arrivals and departures, and other information about the operation of the train.

On passenger trains, the conductor collects tickets and cash fares and makes a detailed report on these and other items at the end of his run. Yard conductors, who are frequently called "yard foremen," direct the activities of the switching crews which make up and break up trains.

Of the 47,000 conductors employed by class I railroads in 1956, about 16,000 were in freight service, 6,000 were on passenger trains, and about 22,000 were in yard service. Another 3,000 men were employed as assistant road passenger conductors and ticket collectors. Switching and terminal companies and the smaller line-haul railways also employed a few thousand conductors.

Training, Other Qualifications, and Advancement

Openings for conductors are filled by promoting qualified brakemen. To qualify as conductors, brakemen must have at least several years' experience and must be able to pass examinations covering signals, air brakes, timetables, operating rules, and related subjects. Assignments to conductor positions are made according to seniority rules, and a brakeman may have to wait many years for his first assignment as conductor. On some roads, experienced brakemen with the necessary seniority take temporary assignments as conductors while they are still working as brakemen. On other roads, brakemen are promoted directly to conductor positions, but are first assigned to the "extra board," which is a list of conductors who are given temporary assignments as men are needed. In either case, brakemen with the greatest seniority may bid for regular assignments as openings arise.

On most roads, yard service and road service have separate seniority lists, and conductors usually remain in one type of service throughout their careers. However, conductors on a few roads may move from yard assignments to freight service and finally to passenger service.

Employment Outlook

A small number of brakemen will be promoted to jobs as conductors each year during the late 1950's and the 1960's. Job openings will develop primarily as a result of the need to replace conductors who die, retire, or leave railroading for some other reason. The employment of conductors declined slightly from 1950 to 1956, and further declines are expected during the next decade as a result of the railroads' continued loss of passenger traffic, the increasing mechanization of yards, and the trend toward longer and fewer trains.

Earnings and Working Conditions

Conductors employed in road service have basic daily wage rates which vary with the types of service, the number of cars within their train, and the location of their job. In December 1956 these rates varied from about $17.50 to $18.90 on local and way freight trains; $16.90 to $18.30 on through freight trains; and $17.70 to $17.75 on passenger trains. Conductors who travel more than 100 miles in passenger service or 150 miles in freight service, or work more than 8 hours a day receive extra pay. Because of extra mileage on fast passenger and through freight runs, and because of longer hours of work on slower local and way freight trains, road conductors frequently earn much more than their daily rate. For example, the average monthly earnings of road freight conductors in December 1956 were $639 on local and way freight trains and $545 on through freight trains. Passenger conductors earned $626 and assistant passenger conductors and ticket collectors averaged $544 in the same month.

Conductors employed in yard service have a basic 8-hour day, and, for work beyond 8 hours,

they are paid one and one-half times their hourly rate. In December 1956, the average monthly earnings of yard conductors were $511.

Conductors on extra work have irregular hours and therefore tend to earn less than conductors with regular runs. When away from their home base, road conductors, whether on regular assignment or on the extra board, pay their own living expenses.

Conductors on every major railroad are covered by union contracts. Freight and passenger conductors are represented primarily by the Order of Railway Conductors and Brakemen, and the Brotherhood of Railroad Trainmen. Yard conductors, or yard foremen, have been organized by the Switchmen's Union of North America, the Order of Railway Conductors and Brakemen, and the Brotherhood of Railroad Trainmen.

Train Baggageman

(D. O. T. 1–43.01)

Nature of Work

Baggagemen are part of the train crew on passenger trains which have baggage cars. At railroad stations, they receive the trunks and other baggage checked by passengers and often handle mail bags and articles sent by Railway Express. During the run they sort these items and make certain that each one is delivered at the proper station, keeping a record of all items received and unloaded. When a train is forced to stop on the road, the baggageman may be required to leave his car and go forward along the track to protect the train by signaling. Nearly 3,000 baggagemen were employed by class I railroads in 1956.

Training, Other Qualifications, and Advancement

Baggagemen jobs are usually filled by experienced brakemen with sufficient seniority who choose to transfer to this position. The work is considered relatively easy as compared with that done by brakemen. Frequently, baggagemen jobs are taken by older brakemen or those who do not want to assume the responsibility of the position of conductor. A baggageman may be promoted to conductor if he has the necessary seniority.

Employment Outlook

There will be few openings in this small occupation during the late 1950's and the 1960's. Employment in the 1956–66 decade is expected to decline because of decreasing passenger service. The few baggagemen positions which become vacant will be filled by promoting or transferring qualified workers from other railroad positions.

Earnings and Working Conditions

Baggagemen on most roads have basic daily wage rates, which ranged from about $15.40 to $16.60 in December 1956. Like conductors and brakemen, they also receive extra pay for exceeding specified daily mileage or hour limits. For example, in December 1956, baggagemen on class I railroads had average monthly earnings of $542.

Most baggagemen are members of unions. The Brotherhood of Railroad Trainmen and the Order of Railway Conductors and Brakemen represent the baggagemen on most roads. Some baggagemen who handle express articles as well as baggage are represented by the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employes.

Telegraphers, Telephoners, and Towermen

(D. O. T. 1–41.22 and 5–44.020)

Nature of Work

Telegraphers and telephoners work in stations or towers where they receive train orders from dispatchers and pass them on to train crews. They also handle other types of communications relating to the railroads' business, such as passenger reservations and information about freight movements. Telegraphers and telephoners transmit train orders by teletype or some other type of printing telegraph machine, but reservations and other railroad business are often relayed by Morse code.

Some telegraphers and telephoners are employed as "block operators" who control the manually operated block-signal systems which are installed along many routes. Others are employed as towermen in control towers and operate track switches and signals to route traffic according to train schedules or special orders. Towermen may also transmit train orders. In large towers where several men are employed, a tower director is in charge. Telegraphers employed in stations often have combination jobs involving ticket selling and related duties as well as handling train orders and messages.

Class I railroads employed about 24,000 workers in the telegrapher, telephoner, and towerman group in 1956. Among these were 14,000 telegraphers, telephoners, and towermen; 1,100 chief telegraphers, chief telephoners, and wire chiefs; and 9,000 workers who combined telegraphing and telephoning with clerical duties in stations.

Training, Other Qualifications, and Advancement

The railroads prefer applicants for positions as student telegraphers to be high school graduates who are under 21 years of age. Applicants must pass a physical examination which has strict eyesight and hearing requirements.

Most student telegraphers receive 6 to 12 months of on-the-job training at a small station, usually under the supervision of the station agent or an experienced telegrapher. They learn Morse code and are instructed in operating rules, train orders, routes, rates, and accounts. Beginners sometimes take 6- to 7-month courses at a railroad telegraph school and then spend 2 or 3 months in training at a station. On many roads, trainees must pass examinations on train operating rules as well as a practical test on Morse code and the handling of train orders in order to qualify for jobs as telegraphers.

Newly qualified workers begin on the "extra board," which is a list of workers who are given temporary assignments as men are needed. As their seniority increases they bid for regular assignments. They may bid not only on straight operator and block operator jobs, but also on towerman, telegrapher-clerk, and telegrapher-station agent positions. Men with the greatest seniority may choose the shifts and stations they prefer, whereas a new telegrapher may be required to work irregular hours at out-of-the-way locations. Telegraphers with the necessary experience and seniority may be promoted to station agent, dispatcher, or wire chief.

Employment Outlook

There will be a small number of opportunities each year for new workers to become student telegraphers during the late 1950's and the 1960's even though employment in this occupational group is expected to decline somewhat. Openings will result from the need to replace experienced workers who die, retire, or transfer to other occupations. Employment in the telegrapher, telephoner, and towerman group dropped from 26,000 in 1950 to 24,000 in 1956 and it is expected to continue to decline in the 1956–66 decade as improved communication devices and the increased use of centralized traffic control systems further reduce the need for these workers.

Earnings and Working Conditions

Th average straight-time earnings in December 1956 of clerk-telegraphers and clerk-telephoners were $2.13 an hour; telegraphers, telephoners, and towermen averaged $2.16. Chief telegraphers and telephoners and wire chiefs averaged $2.45 an hour in the same month. The earnings of student telegraphers were considerably lower.

Telegraphers have a basic 40-hour week, with time and one-half paid for overtime. However, under Federal law they are prohibited from working more than 9 hours a day except in emergencies. Most telegraphers, telephoners, and towermen are members of The Order of Railroad Telegraphers.

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Station Agents

(D. O. T. 1–44.22)

Nature of Work

The station agent is the railroad's official representative at his station in dealings with the public. At small one-man stations, the agent sells tickets, checks baggage, calculates freight and express charges, loads and unloads freight and express packages, and performs many other tasks. He may also serve as telegrapher and telephoner, receiving and delivering train orders and other messages pertaining to the company's business. In larger stations, much of this work is delegated to employees working under the agent's supervision. In the largest freight or passenger stations, the agent primarily performs administrative and supervisory duties.

More than 19,000 station agents were employed by class I railroads in 1956. About 13,000 of these men acted as telegraphers or telephoners; 4,000 were nontelegraphers in smaller stations; and 2,000 had supervisory positions at major stations.

Training, Other Qualifications, and Advancement

Positions as agent in small stations or assistant agent in larger ones are usually filled by promoting experienced telegraphers. A knowledge of routes, rates, accounting methods, signals, and other railroad business is required for station agent positions.

Agents may advance from a small to a large station, or from assistant agent to agent. Station agents may be promoted to supervisory positions such as station master or inspector.

Employment Outlook

Little change in the number of station agents is expected in the late 1950's and the 1960's. A small number of opportunities for assistant agents or telegraphers to be promoted to jobs as station agents will arise each year from the need to replace agents who die, retire, or transfer to other occupations.

Earnings and Working Conditions

Station agents in nonsupervisory jobs are paid either by the hour or by the month; those in supervisory positions are paid by the month. In December 1956, the straight-time hourly earnings of agent telegraphers and telephoners averaged $2.14; nontelegrapher station agents at smaller stations averaged $2.29. Supervisory agents at major stations averaged $2.84 an hour in the same month. Where agents handle the business of the Railway Express Agency, they receive a commission on the business transacted. Station agents have a basic 40-hour workweek, with time and one-half paid for overtime. Most full-time station agents are members of The Order of Railroad Telegraphers.

Railroad Clerks

(D. O. T. 1–11)

Nature of Work

About 120,000 clerks were employed by class I railroads in 1956. The largest group—about 94,000—were employed as ticket sellers, rate clerks (who determine the charges for freight shipments), timekeepers, bill clerks, yard clerks, and baggage room clerks. In small offices or stations, one man may handle several of these jobs, but in large offices with many employees, each clerk usually performs a specialized job. More than 11,000 of these clerks were employed in higher grade jobs involving more responsible or technical work. Some of these clerks prepare the statistics on employment, traffic, equipment, and other subjects required by the Interstate Commerce Commission. Others are cashiers who deal with customers on such matters as uncollected freight bills and undercharges made by the road. Supervisory and chief clerks, numbering about 14,000 in 1956, not only supervise other employees and assume responsibility for their departments, but may be called on to solve highly complex clerical problems.

Training, Other Qualifications, and Advancement

Beginning clerical positions are filled by hiring newcomers or by promoting workers already employed by the company in lower level jobs, such as office boys or messengers. A high school education is usually required, and clerical aptitude tests are sometimes given. Workers with training or experience in working with figures are preferred by the railroads.

In many offices a clerk may advance to assistant chief clerk, chief clerk, and higher administrative positions. Some clerks may move from routine clerical jobs to work requiring special knowledge of accounting or statistics, which may lead eventually to positions such as auditor. Clerks may also be promoted to jobs as traffic agents, buyers, storekeepers, or ticket and station agents.

Employment Outlook

Employment of clerical personnel will probably decline in the 1956–66 decade. Further mechanization and more efficient accounting procedures will make it possible for fewer clerks to handle a given amount of business. In addition, it is expected that more electronic data-processing machines will be used to handle much of the railroads' large-scale recordkeeping and accounting work.

However, several thousand openings in clerical positions are expected to arise each year during the late 1950's and the 1960's as a result of replacement needs. In an occupational group as large as this, many openings will result from the need to replace workers who die, retire, or transfer to other fields of work.

Earnings and Working Conditions

The average straight-time hourly earnings of clerks in lower grade jobs were $2.14 in December 1956. Senior clerks and clerical specialists averaged $2.47, supervisory cashiers and chief clerks of minor departments averaged $2.59, and supervisory and chief clerks of major departments averaged $3.07 in the same month. Railroad clerks have a basic 40-hour workweek, with time and one-half for overtime.

The Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employes represents the clerks on all major roads.

Redcaps

(D. O. T. 2–92.30)

Nature of Work

Redcaps carry baggage for railroad passengers, either by hand or on trucks. They check luggage, buy tickets, make telephone calls, and perform other services for travelers. They also answer questions on such subjects as train schedules and the tracks on which particular trains will arrive or depart. At a few stations, they announce the trains, stock the timetable racks, and do cleaning and other work. About 3,500 redcaps were employed by class I railroads in 1956.

Training, Other Qualifications, and Advancement

Hiring standards for redcap jobs vary from company to company. As a rule, applicants are required to be at least 18 and not over 45 years of age. They must be able to read and write and pass physical examinations. Redcaps must be strong enough to carry heavy baggage. Promotional opportunities for redcaps are limited; a few may become assistant captain or captain in their station.

Employment Outlook

There will be only a small number of opportunities for new workers to obtain jobs as redcaps each year during the late 1950's and the 1960's. Openings will arise primarily from the need to replace redcaps who die, retire, or transfer to other fields of work. However, as openings develop, redcaps on furlough may be rehired before new workers are taken on. Like other groups whose employment depends mainly on the volume of railroad passenger traffic, the number of redcaps will probably decrease in the 1956–66 decade.

Earnings and Working Conditions

The average straight-time earnings of redcaps in December 1956 were about $1.70 an hour. In addition to their wages, they keep any tips which passengers give them over the regular charge for baggage. The standard baggage fees are collected by the redcaps and turned in to their employers.

Redcaps who have worked at least 133 days during the previous year receive vacations with pay. A 1-week vacation is given to redcaps with less than 5 years of service, 2 weeks to those with more than 5 years of service, and 3 weeks to those with more than 15 years of service.

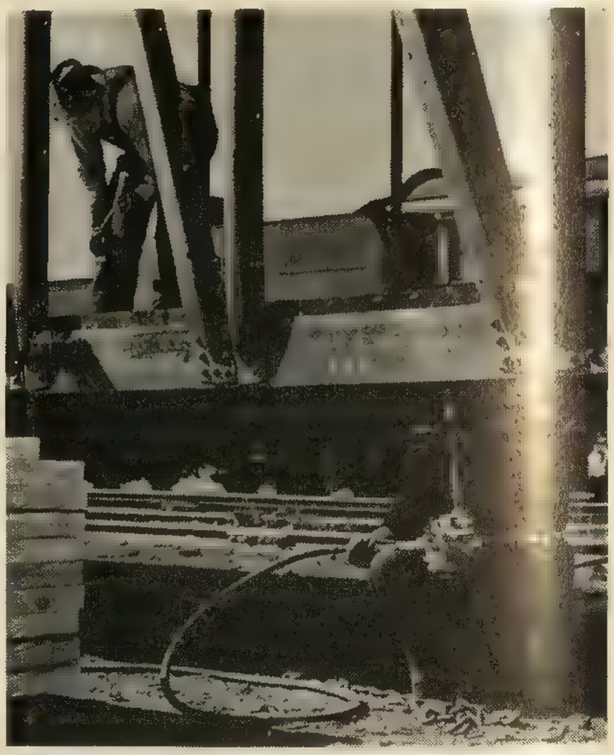
Most redcaps are members of unions. They are represented primarily by the Brotherhood of Railway and Steamship Clerks, Freight Handlers, Express and Station Employes, and by the United Transport Service Employees.

Shop Trades

Nature of Work

The skilled workers who build, maintain, and repair railroad cars and locomotives are divided into 6 main "shop crafts": carmen, machinists, electrical workers, sheet metal workers, boilermakers, and blacksmiths. An average of nearly 143,000 journeymen mechanics worked in these 6 crafts in 1956. In addition, there were nearly 44,000 helpers and more than 7,000 apprentices.

Carmen, who numbered more than 76,400 on class I railroads in 1956, build, maintain, and repair railroad freight and passenger cars. They also do some work on locomotives and smaller vehicles, such as the motor cars used in transporting workers along the tracks. Because of the wide variety of jobs they may be called on to handle, most carmen are skilled in both carpentry and metalworking and can use power equipment as well as handtools. The carmen group also includes upholsterers, car painters, and patternmakers who are skilled only in their particular specialities. Some carmen work as car inspectors, examining cars in the yards and stations for defects that might cause train accidents or delays.



Carmen rebuilding freight car.

Machinists are the second largest group of skilled shop workers, numbering about 31,300 on class I railroads in 1956. They assemble and dismantle equipment, make and repair parts, and do related work, mainly on locomotives. Electrical workers, of whom more than 17,800 were employed, install and maintain wiring and electrical equipment on locomotives, passenger cars and cabooses, as well as in buildings owned by the railroads. Boilermakers, numbering about 4,200, work mostly in locomotive shops where they maintain and repair locomotive and stationary boilers, fireboxes, tanks, and other parts made of sheet iron or heavy sheet steel. Sheet metal workers, who numbered about 9,300, install and maintain light sheet metal parts, and do pipefitting on cars, locomotives, and other equipment. Nearly 3,300 blacksmiths were employed to forge and fabricate parts, such as springs and side rods for locomotives and other equipment. Other important shop workers are stationary firemen, oilers, and stationary engineers (steam). (Detailed discussions on the nature of the work for some of the above shop trades may be found elsewhere in this Handbook. See index for page numbers.)

Training, Other Qualifications, and Advancement

Apprenticeship is the usual way of entering the shop crafts. The beginning craftsman either works 4 years as an apprentice, or 2 years as a helper and then 3 more years as a helper-apprentice.

The railroad industry has one of the best systems of apprentice training in the country. Definite standards for the training of apprentices are incorporated in the agreements negotiated by the shopmen's unions with the railroad managements. Apprentices are trained in all branches of their respective trades and, upon completion of their training, receive a certificate which certifies that they are qualified journeymen.

To become a regular apprentice, the applicant must be at least 16 and not over 21 years of age; to become a helper-apprentice, he must be no older than 30, although younger men are desired. On some roads, applicants for regular apprentice positions are required to pass aptitude tests in mathematics and mechanics. Preference is usually given to relatives of railroad employees, providing they meet hiring standards.

Employment Outlook

There will be several thousand opportunities for new workers to obtain jobs as helpers or apprentices in the shop crafts during the late 1950's and the 1960's. Openings will result primarily from the need to replace experienced craftsmen who die, retire, or transfer to other fields of work.

The number of journeymen mechanics employed in the shop crafts declined from an average of 163,000 in 1950 to an average of 143,000 in 1956. Despite the expected increase in the amount of rolling stock required to handle the anticipated growth in freight traffic, some further small decline in employment appears likely in the shop crafts in the 1956–66 decade. The factors which will enable the railroads to handle more maintenance work with a somewhat smaller maintenance workforce include the greater specialization of labor, the substitution of new and more durable rolling stock, better designed locomotives and cars, and continued replacement of steam locomotives by diesels.

Not all maintenance crafts will be affected in the same way by the technological changes now going on in the railroad industry. For example, the number of electrical workers will probably increase because of the growing use of diesel-electric power and the introduction of more complex electrical and electronic equipment in railroad rolling stock. On the other hand, the decline in the number of boilermakers is expected to continue because their skills are not required as much in the repair of diesel locomotives as in the repair of steam engines.

Earnings and Working Conditions

The average straight-time hourly earnings in December 1956 for journeymen in the shop trades were: Blacksmiths, $2.29; boilermakers, $2.31; carmen, $2.24; electrical workers, $2.28; machinists, $2.29; and sheet metal workers, $2.29. In each craft, an additional differential is paid for special types of work.

Helpers in all crafts averaged $1.99 an hour in December 1956. Helper-apprentices started at about $1.90 an hour and, through regular increases, worked up to the journeymen's rate at the end of 3 years. Regular apprentices started at a lower rate, usually about $1.67 an hour, and worked up to the journeymen's rate after 4 years. Shop workers have a basic 40-hour workweek, with time and one-half paid for overtime.

Much of the work on railroad cars is done outdoors, and workers are on the job in all kinds of weather. However, major repairs on locomotives are generally made indoors in the engine houses or locomotive shops.

Most shop workers are members of unions. Among the important unions in the field are: Brotherhood Railway Carmen of America; International Association of Machinists; International Brotherhood of Boilermakers, Iron Ship Builders, Blacksmiths, Forgers and Helpers; International Brotherhood of Electrical Workers; Sheet Metal Workers' International Association; and International Brotherhood of Firemen and Oilers. In collective bargaining, these unions usually operate through the Railroad Employes' Department of the AFL–CIO.

Trackmen

(D. O. T. 0–98.71, 7–23.121, and 9–32.01)

Nature of Work

Trackmen construct, maintain, and repair railroad tracks and roadways. They aline and weld rails, replace defective ties, and perform other related tasks. The regular year-round track work force is organized into section gangs, usually made up of 5 or 6 men and a foreman. Some roads have division or "extra" gangs which are much larger and do major construction and repair work. The section and extra gangs often include skilled specialists who operate heavy equipment, such as cranes and bulldozers.

Either the foremen or certain section men called "track walkers" make regular inspections of the right-of-way, looking for cracked rails, weak ties, washed-out ballast, and other track and roadway defects. Section or division gangs then make the necessary repairs, using hand tools, such as picks, shovels, and hammers as well as power equipment, such as mechanical and multiple tampers, power wrenches, and ballast cleaners.

In 1956, an average of 78,000 section men and 26,000 extra gang men were employed by class I railroads. Employment of these workers varies considerably with the seasons. For example, employment of section men ranged from 77,000 in January 1955 to 90,000 in July 1955, and employment of extra gang men ranged from 18,000 in January 1955 to 37,000 in July 1955. In 1956, class I railroads also employed more than 21,000 section and extra gang foremen and nearly 7,000 portable equipment operators and helpers.

Training, Other Qualifications, and Advancement

Most roads prefer workers who are between the ages of 21 and 45 for their track work force. Men seeking work as trackmen must pass a physical examination and be able to do heavy work. There are no specific educational requirements, but a high school education is important for those who wish to become foremen.

Most trackmen are trained on the job. New employees usually start as helpers, and gradually acquire the necessary skills. It usually takes about 2 years for a man to become an all-round trackman.

Trackmen operating spike-pulling machine

Trackmen may be promoted to foreman or assistant foreman providing they have the necessary seniority. Some qualified foremen may be advanced to supervisory positions such as track supervisor, division engineer, or division superintendent.

Employment Outlook

Despite the expected decline in the total track work force, several thousand workers without previous railroad experience will be hired each year during the late 1950's and the 1960's to meet the expanded seasonal needs for trackmen during the summer months and to fill vacancies created by the high turnover rate. Employment of trackmen declined from an average of about 174,000 in 1950 to about 125,000 in 1956. During the 1956–66 decade, employment of trackmen is expected to continue to decline as maintenance-of-way work becomes increasingly mechanized. The mechanization trend is indicated by the increase in the number of portable equipment operators employed by the railroad industry from 5,100 in 1950 to 6,600 in 1956.

Earnings and Working Conditions

Trackmen are among the lowest paid workers in the railroad industry. Section men and extra gang

men had average straight-time earnings of about $1.77 an hour in December 1956. On a yearly basis, however, extra gang men tend to have less income than section men since they often work only part of the year. Portable equipment operators averaged $2.15 an hour and section foremen and extra gang foremen averaged $2.16 and $2.19 respectively, in December 1956.

Trackmen work a basic 40-hour week, and time worked in excess of 8 hours a day or 40 hours a week is paid for at time and one-half rates.

Since section men work on only a few miles of track, they are usually able to live at home. Trackmen in extra gangs often travel from place to place and must live in camp cars or trailers, where they pay for their own food. Men operating mechanical equipment frequently serve several divisions or an entire railway, and they may have to spend a great deal of time away from home, often living in camp cars.

Most trackmen are members of the Brotherhood of Maintenance of Way Employees.

Bridge and Building Mechanics

(D. O. T. 5–25.840)

Nature of Work

Bridge and building mechanics build, maintain, and repair tunnels, bridges, stations, water tanks and a variety of other structures owned or operated by railroads. Nearly 17,000 bridge and building mechanics were employed by class I railroads in 1956. Among these workers were more than 11,000 carpenters, all-round mechanics who do many types of construction work in addition to carpentry; nearly 3,000 masons, bricklayers, plasterers and plumbers; more than 2,000 painters; and nearly 1,000 ironworkers. Class I railroads also employed about 6,000 helpers and apprentices and nearly 4,000 foremen in this type of work.

Training, Other Qualifications, and Advancement

New employees start as helpers or apprentices and receive their training on the job. They usually serve several years as helpers before they can qualify as mechanics. As openings occur in skilled mechanics' jobs, they are filled by promoting qualified helpers with the greatest seniority. Journeymen with the necessary experience and ability may advance to positions as foremen, inspectors, or bridge and building supervisors.

Employment Outlook

A small number of job openings in the bridge and building work force will arise each year during the late 1950's and the 1960's, although the overall number of these workers may decline somewhat. Employment of bridge and building workers decreased from 29,000 in 1950 to about 27,000 in 1956. Employment of these workers is expected to continue to decline slowly because of the increasing use of power tools and labor-saving equipment and the use of more durable materials, which require less maintenance and repair. However, deaths, retirements, and transfers to other fields of work will provide some job opportunities for new workers. Helpers, in particular, have relatively high turnover rates.

Earnings and Working Conditions

The average straight-time earnings of bridge and building carpenters in December 1956 were $2.08 an hour. Masons, bricklayers, plasterers, plumbers, and ironworkers averaged $2.24, and painters $2.09 in the same month. Helpers and apprentices averaged $1.92. Bridge and building workers have a basic 8-hour day and are paid time and one-half for work beyond 8 hours.

Bridge and building men are often away from their homes for days at a time. On these occasions, they usually live in camp cars supplied by the railroads, but they pay for their own food.

The Brotherhood of Maintenance of Way Employees represents the bridge and building workers on most roads.

Signalmen and Signal Maintainers

(D. O. T. 5–79.170)

Nature of Work

Signalmen and signal maintainers construct, install, maintain, and repair the signaling systems which control the operation and movement of trains. Signal maintainers inspect and repair railroad signals within a given territory. They see that the lights, switches, other controlling devices, and wires are in good operating condition. This work requires a thorough practical knowledge of electricity and considerable mechanical skill. Work on the newer systems also requires a knowledge of electronics.

Signalmen, who generally have the same skills and knowledge required of maintainers, are primarily concerned with installing and constructing new signals and signal systems. They work in gangs and travel from one part of the road to another, wherever there is construction work to be done. In constructing a signal system, signalmen, assisted by helpers, often build forms for concrete, mix and pour cement, weld metal, and do many other types of work in addition to electrical work.

In 1956, class I railroads employed more than 8,700 signalmen and signal maintainers; 1,700 gang foremen; 2,400 assistants; and 2,300 helpers.

Signal maintainer making repairs on wayside signal.

Training, Other Qualifications, and Advancement

Railroads prefer men between the ages of 18 and 35 with a high school education or its equivalent for their signalman or signal maintenance jobs. Knowledge of electricity and mechanical skill are assets to young men seeking these jobs.

New employees start as helpers doing semiskilled work under the direction of an experienced man. After about 1 year of training on the job, a helper usually becomes an assistant. As openings in signalmen jobs occur, they are filled by promoting qualified assistants according to seniority rules. It generally takes 4 years for an assistant to become a signalman or signal maintainer.

Both signalmen and signal maintainers may be promoted to more responsible positions, such as inspector or testman, foreman, leading signalman, or leading signal maintainer. A few may advance to assistant supervisor or signal engineer.

Employment Outlook

Unlike most other railroad occupations, the number of signal workers is expected to increase somewhat during the late 1950's and the 1960's. In addition, several hundred job opportunities for new workers will result from the need to replace experienced workers who die, retire, or transfer to other fields of work.

The increasing mechanization of railway signal systems and railroad yards should result in an increase in the number of workers who install and maintain electrical systems. The amount of maintenance required by railroad signal systems does not change greatly with variations in traffic or with the seasons; consequently, workers in this field tend to have more job security than many other railroad workers.

Earnings and Working Conditions

The average straight-time hourly earnings of signalmen and signal maintainers in December 1956 were $2.29. Gang foremen averaged $2.47. Assistant signalmen and signal maintainers averaged $2.10 an hour and helpers $1.98 in the same month. Signal workers have a basic 8-hour day, and are paid time and one-half for work beyond 8 hours.

Signal work is steady throughout the year, although on some northern roads, signal crews are likely to have less work during periods of bad weather. Signalmen often work away from their home base. On these occasions, many railroads provide camp cars for living quarters, although the men pay for their own food. Signal maintainers are generally able to live at home since they maintain signals only in a given area.

Most signal work is done outdoors, and repairs must be made regardless of the time of day or the weather conditions. Signalmen often climb poles to make repairs on signaling devices. In addition, they work near high tension electric wires and on unguarded railroad tracks.

Most signal workers are members of the Brotherhood of Railroad Signalmen of America.

Pullman Conductors

(D. O. T. 0–92.31)

Nature of Work

Pullman conductors are employed on trains with several sleeping cars or other pullman cars. They collect tickets from passengers for berths, bedrooms, and other accommodations. They assign space to those who come aboard without reservations or who wish to change their accommodations, and they keep records of the tickets collected and space assigned. They also supervise porters and other employees on the pullman cars. Although employed by the Pullman Co., they are responsible to the railroad conductor during the run. About 1,400 men were employed as pullman conductors in 1956.

Training, Other Qualifications, and Advancement

Applicants for positions as pullman conductor must be between the ages of 25 and 45. A high school education or its equivalent is preferred by the Pullman Co. The conductor's work entails constant contact with the public, so he must be able to deal effectively with people.

Newly hired conductors undergo training for a period of not more than 60 days, during which they are paid at the regular daily rate. After this initial training, they begin work on the "extra board," which is a list of conductors who are given temporary assignments as men are needed. Conductors may work on the extra board for many years before they receive a regular assignment.

Experienced conductors with unusual abilities may advance to supervisory positions. Some pullman conductors transfer to clerical jobs in Pullman Co. offices.

Employment Outlook

Few job opportunities will arise in this small occupation during the late 1950's and the 1960's. Many of the openings that arise because of deaths, retirements, and transfers to other occupations will probably be filled by the rehiring of furloughed pullman conductors. As a result, few new workers will be taken on. Like other railroad employees whose employment depends mainly on the volume of first-class passenger traffic, the number of pullman conductors will probably decrease in the 1956–66 decade.

Earnings and Working Conditions

Beginning pullman conductors were paid a monthly rate of $429.75 for a basic 205-hour month in December 1956, with straight-time rates paid between 205 and 215 hours, and time and one-half paid for work thereafter. Basic monthly pay rates are increased to $439.75 after 1 year of service; $447.75 after 2 years; $454.75 after 5 years; $457.75 after 10 years; and $462.75 after 15 years of service.

The collective bargaining agent for pullman conductors is the Order of Railway Conductors and Brakemen.

Pullman Porters and Passenger Attendants

(D. O. T. 2–91.10)

Nature of Work

Sleeping car porters make up berths, keep the cars in order, see that washrooms are clean and adequately supplied with towels, handle baggage, and look after the passengers' comfort in many other ways. Porters-in-charge, who are employed on some trains that do not have pullman conductors, collect pullman tickets, sell space and keep records, in addition to handling regular porter duties.

On club cars and other cars where refreshments are served, attendants prepare and serve beverages and light meals and also perform any necessary porter work. Busboys often assist the attendants on large club cars.

In 1956, about 7,000 porters were employed by the Pullman Co., mainly on sleeping cars. Among these were about 600 attendants and 200 busboys.

Training, Other Qualifications, and Advancement

Applicants for porter jobs should be between 21 and 45 years of age, and be able to read, write, and make simple mathematical calculations. All prospective porters undergo a physical examination and porters who handle food are reexamined every 90 days. Most porters are Negroes; a few are Filipinos.

To qualify for an attendant's job, a man is usually required to have experience as a busboy. Applicants for attendant and busboy positions must be able to meet requirements with regard to health and education similar to those of porters.

Beginning porters go through a training period of approximately 2 weeks, consisting of instruction under a porter-instructor, and actual work on a train under the supervision of an experienced porter. After this training period, the employee begins work as a porter but is placed on probation for a 6-month period. New porters start out on the "extra board," which is a list of workers who are given temporary assignments as men are needed, and then bid for regular assignments as they gain seniority.

Bus boys may be promoted to attendant positions when openings occur. Porters may become porters-in-charge, porter-investigators, or porter-instructors.

Employment Outlook

A limited number of opportunities in these small fields will arise in the late 1950's and the 1960's because of deaths, retirements, and transfers to other occupations. However, many of these openings will probably be filled by the rehiring of furloughed workers. A few men may be hired for porter and attendant work to meet temporary seasonal needs. Like other groups whose employment depends mainly on the volume of first-class passenger traffic, the employment of porters and attendants is expected to decrease in the 1956–66 decade.

Earnings and Working Conditions

Porters, attendants, and busboys have a minimum guaranteed monthly wage based on 205 hours of work. Extra men do not have a guaranteed wage, but the companies try to maintain their earnings at no less than two-thirds of the basic month's pay. Time and one-half is paid for work in excess of 240 hours a month.

The basic monthly rate for pullman porters was \$325.06 in December 1956, and \$331.06 for attendants. The monthly rates are increased at the end of the second year of service and at other specified intervals, up to a maximum of \$336.06 for porters and \$347.16 for attendants after 15 years of service. Busboys start at \$324.36 a month and reach a maximum of \$333.06 after 15 years of service. These rates do not include tips, which vary with the type of work.

On night runs, sleeping-car porters are provided sleeping accommodations. The porter in the adjacent car services the car of the porter released for sleep. Employees may buy dining car meals at approximately 60 percent of the regular price. Porters are represented by the Brotherhood of Sleeping Car Porters. Attendants and busboys are represented primarily by the Hotel and Restaurant Employees and Bartenders International Union.

Dining Car Cooks

(D. O. T. 2-26.40 through .49)

Nature of Work

Dining car cooks prepare the meals served on trains. There may be from 1 to 4 cooks in a dining car kitchen, depending on the size of the kitchen and the number of customers expected. When 4 cooks are employed, the chef and the other cooks each have specialized tasks. The chef supervises the kitchen and instructs other members of the crew. He also roasts and carves meats and poultry, garnishes dishes, and takes inventories of supplies. The 2d cook fries and broils meat, bakes muffins and rolls, and puts the food on the plates. The 3d cook prepares soup, vegetables, and coffee and works at the steam table. The 4th cook, or "helper," is the vegetable peeler, dishwasher, and general clean-up man. Many dining cars carry fewer than 4 cooks, and each man is therefore required to perform some additional tasks.

Dining car cooks preparing food.

Training, Other Qualifications, and Advancement

The railroads prefer applicants who have a high school education and who have had some experience in the preparation of food. They must be able to pass very strict physical examinations and are tested for communicable diseases periodically thereafter.

New workers generally begin as 4th cooks and are given only temporary assignments. As the cook gains experience, he is usually assigned a regular run. Most dining car cooks are Negroes, although some western and northern roads employ white cooks.

After 2 or 3 years' experience, a 4th cook may be promoted to 3d cook. He may remain in this job for 5 or more years before becoming a 2d cook, after which it generally takes an additional 3 to 5 years to work up to the position of chef.

Employment Outlook

A limited number of opportunities will arise in this small field in the late 1950's and the 1960's. A few new cooks will be hired to handle temporary seasonal peaks in passenger service and to replace men who die, retire, or leave the occupation for other reasons.

The number of cooks employed by class I railroads declined from 4,400 in 1950 to 3,300 in 1956. Like other groups whose employment depends mainly on the volume of first-class passenger traffic, dining car cooks will continue to decrease in number in the 1956-66 decade.

Earnings and Working Conditions

The average straight-time hourly earnings in December 1956 of cooks and chefs working for Class I railroads were $1.86. Basic monthly rates ranged from about $280 a month for 3d and 4th cooks to $350 a month for chefs.

Cooks had a work schedule of 205 hours a month in 1956. On most roads, time and one-half is paid for hours over 240. When they are away from their home terminals, cooks are provided free meals and sleeping quarters.

Disabling injuries are more frequent among cooks than among most other groups of railroad workers because they work with sharp knives and near hot stoves, and the sudden jerks and swaying of the dining car increase the danger of their being cut or burned.

Cooks and chefs are organized mainly by the Hotel and Restaurant Employees and Bartenders International Union.

Dining Car Waiters

(D. O. T. 2–27.95)

Nature of Work

These workers are employed by the railroads to serve meals in dining cars. Most dining cars carry a full crew of 6 waiters, each of whom has several specific duties in addition to taking orders from customers, serving them food, and removing dishes from tables. Two waiters serve as "pantrymen" and are responsible for the proper storage of food and the preparation of salads. One waiter takes care of the linen and water bottles, while another waiter washes, cleans, and polishes the larger pieces of silverware, such as sugar bowls, ice tubs, and finger bowls. Another waiter is responsible for the flat silver and glassware, and the remaining waiter keeps the floors clean. When the crew of waiters is smaller, each man handles several of these assignments.

Dining car waiters serving customers.

Training, Other Qualifications, and Advancement

Previous experience as a waiter is an asset to men seeking positions with the railroads. Railroads prefer high school graduates who are in their early twenties, fairly tall, and of pleasing appearance. Each new waiter is given a thorough physical examination and is tested for communicable diseases periodically. Most dining car waiters are Negroes although some northern and western roads employ white waiters. Advancement for waiters is limited. A few waiters may become waiters-in-charge who supervise the other employees on dining cars with very small staffs.

Employment Outlook

A limited number of job opportunities for new workers in this small field will arise in the late 1950's and the 1960's primarily to replace experienced waiters who die, retire, or transfer to other fields of work. Some new workers may be hired for temporary assignments during seasonal peaks in passenger service.

Employment of dining car waiters declined from 10,000 in 1950 to less than 8,000 in 1956. Like other groups whose employment depends mainly on the volume of first-class passenger traffic, dining car waiters are expected to continue to decrease in number in the 1956–66 decade.

Earnings and Working Conditions

Waiters' wage rates are lower than those of cooks, but their earnings are supplemented by tips. Their average straight-time hourly earnings in December 1956 were $1.67, plus their tips. Waiters who serve as pantrymen are paid a few dollars extra each month. In addition, waiters who go through the railroad coaches selling sandwiches and other items receive a small commission on their sales. Waiters generally have a basic 205–hour work month and receive time and one-half pay for working more than 240 hours.

Waiters are organized primarily by the Hotel and Restaurant Employees and Bartenders International Union.

RESTAURANT OCCUPATIONS

The Restaurant Business and Its Workers

Millions of Americans lunch in a restaurant every working day or "eat out" under other circumstances—while traveling, as a celebration, or because they live in rooms without cooking facilities. In 1956, over $15 billion was spent for food eaten away from home—approximately one-fourth of the total amount spent for food in this country.

The business of preparing and serving the vast amount of food consumed in public eating places requires a great number of workers. More than a million men and women were employed in 1954 in the approximately 200,000 separate establishments whose main business was to serve food. In addition, thousands of cooks, waiters, and other food service workers were employed in hotels, department stores, and other establishments which serve meals in connection with some other primary business. These figures exclude the many thousands of proprietors who participate in the management and operation of their own restaurants.

Nature and Location of Restaurant Business

Establishments which cater to the American custom of "eating out" range from roadside diners to elegant and expensive restaurants. The kind of food offered and the way it is served depend primarily on the type of customer the restaurant seeks to attract. For example, in cafeterias and other restaurants where large numbers of workers eat lunch on workdays, rapid service and inexpensive meals are emphasized. On the other hand, expensive food is served in a formal and leisurely manner in some restaurants where the customers have more time and are willing to pay higher prices.

Most restaurants are small independent businesses, many of them operated by their owners with no paid help or with the aid of only one or two part-time workers. Less than 10 percent of the restaurants are run by proprietors who own more than one restaurant or by organizations that operate restaurant chains. However, this group includes some of the country's largest restaurants. Although the average eating place employed only about 5 workers in 1954, some of the large restaurants had 100 or more employees.

Restaurant employment is concentrated in large cities, but even the smallest community has its coffee shop, luncheonette, or roadside restaurant. The number of restaurant employees in each State is directly related to the population. In fact, if all States were ranked by number of restaurant workers, their order would be approximately the same as their rank by population.

Restaurant Occupations

Waiters and waitresses are the largest group of restaurant employees. In large eating places, they are usually supervised by captains, head waiters or waitresses, or hostesses, who also usually greet guests and escort them to tables.

Cooks and chefs, the next largest occupational group, help establish a restaurant's reputation through their cooking skill. They may be supervised by a head cook or chef, who may also prepare menus, create new dishes, assist in purchasing food, and in training new cooks.

Restaurants also employ a variety of other workers: Bus boys and girls who clear tables and carry soiled dishes back to the kitchen; dishwashers, vegetable cleaners and peelers, and other kitchen helpers; and janitors and porters who dispose of trash and garbage, sweep and mop floors, and do other cleaning jobs. Many of these workers operate mechanical equipment, such as automatic dishwashers, vegetable slicers and peelers, and garbage disposal units, which eliminate much drudgery and physical exertion.

Managers, other than proprietors, comprise a small proportion of all restaurant employees. They are responsible for coordinating all aspects of restaurant activities—the purchase, preparation, and service of food—in order to insure efficient and profitable operations and give maximum satisfaction to customers. Large restaurants usually also employ assistant managers, who may

help managers direct the entire restaurant operation or may be in charge of a special area of work such as food purchasing.

Some clerical workers are also employed in restaurants. Cashiers, who receive payments from customers and make change for them, are the largest group. In addition, some large cafeterias employ food checkers, who itemize and total customers' orders, and many large restaurants have bookkeepers, stenographers and typists, and other clerks. A few thousand specialized workers including musicians and other entertainers, dietitians, accountants, and personnel workers are also employed by restaurants.

The key occupational groups in restaurants—waiters and waitresses, cooks and chefs, and managers—are discussed in detail later in this chapter. Many of the clerical and professional occupations found in restaurants, as well as in other industries, are discussed elsewhere in the Handbook. (See index for page references.)

Employment Outlook

Thousands of openings in restaurant occupations are expected each year, continuing into the 1960's. Although many new jobs will be created by the growth of the restaurant business, most openings will result from turnover. Turnover is always high among waitresses, primarily because of the large number of women who work only a short time and leave to take care of family responsibilities. Turnover will also remain high among kitchen helpers and in other relatively low-skilled jobs as long as workers find it easy to shift to other jobs. Therefore, most of the job openings will be for waiters and waitresses, and kitchen helpers—both because of high turnover rates and because these workers are among the largest groups of restaurant employees. In addition, employment opportunities are expected to be favorable for people who are skilled cooks and those who can qualify as restaurant managers. There will also be a number of openings in clerical jobs such as cashier, bookkeeper, stenographer, and typist. The need for young people trained for specialized positions, such as food manager and dietitian, is also expected to continue.

In the long run, restaurant employment is likely to increase at least as fast as the labor force as a whole. During the immediate postwar period, employment in restaurants rose at a much more rapid rate than did the entire labor force. This rise was due not only to the fact that more workers were available to fill vacancies and to the expansion in eating facilities which resulted from the lifting of building restrictions, but also to the greater number of people eating out. In recent years, restaurant employment has been rising at a slower pace; nevertheless, between 1948 and 1954, the rate of increase was still somewhat greater than that of the total labor force.

Further expansion of the restaurant business is anticipated because of several major factors—rising population and income levels, more women working outside the home, increased leisure time owing to shorter workweeks, longer vacation periods, and a greater volume of travel. The Nation's long-range multibillion dollar program of highway construction will undoubtedly be a special stimulus to automobile travel and hence to the restaurant business.

The number of restaurant workers will rise as a result of growth in business though employment may be affected somewhat by technological and other changes. Factors which will tend to restrict the gain in employment include the widespread use in restaurant kitchens of precut meats and precooked and frozen foods and the installation of new and improved equipment such as automatic dishwashers, vegetable cutting and peeling machines, and waste disposal units. However, these factors are not expected to greatly affect restaurant employment.

In the event of a sharp drop in business and employment in many industries, the applicants for restaurant jobs might well exceed the number of openings, since much of the work in eating places—waiting on tables, dishwashing, cleaning vegetables, and other jobs—can be done by persons with little or no experience or training. However, it should be noted that employment in the restaurant business increased even during the depressed 1930's.

Where To Go for More Information

Additional information on the restaurant business as a field of work may be obtained from State and local restaurant associations and from:

Educational Director, National Restaurant Association, 8 South Michigan Ave., Chicago 3, Ill.

Hotel and Restaurant Employees and Bartenders International Union, 525 Walnut St., Cincinnati 2, Ohio

Additional information on training opportunities in the restaurant field may be obtained by writing to:

The National Council on Hotel and Restaurant Education, P. O. Box 7727, Benjamin Franklin Station, Washington 4, D. C.

Additional information on the restaurant business and its workers is available in:

Training Restaurant Sales Personnel, Federal Security Agency, Vocational Division Bull. 222, Superintendent of Documents, Washington 25, D. C. Price 65 cents.

Establishing and Operating a Restaurant, U. S. Department of Commerce (Revised edition, 1957). Superintendent of Documents, Washington 25, D. C. Price 70 cents.

High school students may obtain information on courses relating to restaurant work by writing to the local Director of Vocational Education, Superintendent of Schools in their community or the State Director of Vocational Education in the Department of Education in the State capital.

Waiters and Waitresses

(D. O. T. 2–27.01 through .12)

Nature of Work

Waiters and waitresses spend most of their time taking guests' orders, serving food and beverages, making out checks, and, sometimes, collecting payments. However, the kinds of service they give are largely determined by the type and size of the establishment in which they work. In diners, luncheonettes, and many other small restaurants, the emphasis is on quick service with a minimum of frills. Waiters and waitresses in such eating places may have to clear tables, carry soiled dishes to the kitchen, and clean equipment, in addition to serving food. Sometimes they combine counter service, cashiering, or other duties with waiting on tables. In many formal restaurants, waiters and waitresses serve food at a more leisurely pace and are expected to observe established rules of correct food service. They may advise guests on the choice of wine for each food course or answer questions about how the food is prepared. They are sometimes assisted by bus boys or girls who carry used dishes to the kitchen, set tables, and perform other duties incidental to meal service. In large restaurants, waiters and waitresses may be supervised by captains, hostesses, headwaiters, or headwaitresses; in small eating places, they may work directly under the supervision of the owner or manager.

PHOTOGRAPH BY U. S. DEPARTMENT OF LABOR

Waitress preparing table for guests.

Where Employed

Most waiters and waitresses are employed in restaurants, luncheonettes, cafeterias, nightclubs, and other separate establishments which are primarily eating and drinking places. The next largest number work in hotels. Considerable numbers are employed in schools, hospitals, and other institutions; in retail stores; in private clubs; and in railroad dining cars. A few work on passenger ships, for catering businesses, and in other establishments.

Altogether, more than half a million people are employed as waiters and waitresses—more than in any other service occupation. (See chart 34, p. 210.) Women far outnumber men in this occupation, but men are employed in many restaurants, especially the more formal and expensive ones.

Training and Other Qualifications

Although it is still possible to enter this occupation with little formal schooling, more and more employers prefer to hire beginners with at least 2 or 3 years of high school. Special courses for waiters and waitresses, given by vocational schools, restaurant associations, and individual hotels, are considered good preparation by most employers. Some restaurants hire inexperienced workers and give them a few weeks of on-the-job training, often first as bus boys or girls and later as waiters and waitresses. On the other hand, many restaurants—especially those with the more formal type of service—hire only experienced personnel.

Waiters and waitresses must be able to do the simple arithmetic needed to add food checks and make tax computations. They should speak English reasonably well, have a friendly manner, know how to put people at ease, and be neat and clean in their personal appearance. Health certificates are frequently required of waiters and waitresses to indicate that they are free from communicable diseases.

Experienced waiters or waitresses may transfer to jobs in better paying restaurants and advance to supervisory positions such as headwaiter or hostess. Supervisory workers may sometimes advance to managerial positions.

Employment Outlook

Employment opportunities for waiters and waitresses were good in 1956 and are expected to remain so during the rest of the 1950's. Most openings for beginning waitresses will probably continue to arise from turnover in the relatively low-price restaurants where the majority of women in this occupation are employed. Competition will remain keen for the better paying jobs in higher price restaurants. The rate of turnover in these jobs is relatively low since most of them are filled by men. Moreover, since the better restaurants have high job standards, they usually prefer to hire experienced waiters. A considerable number of temporary jobs will become available each summer in resort hotel dining rooms and other eating places. College students and local workers are usually hired for these jobs.

Over the long run, most openings for waiters and waitresses will continue to arise from the need to replace those who leave the occupation. However, additional waiters and waitresses will be needed as the restaurant business expands owing to growth of population, rising individual incomes, the trend toward eating more meals away from home, and other factors. (See employment outlook statement at the beginning of this chapter.)

Earnings and Working Conditions

In general, waiters and waitresses are paid only a small wage, often regarded as little more than a token payment. Total earnings in this occupation depend not only on the wages received, but also on tips, which may comprise a high proportion of earnings. The amount received in tips varies considerably, depending on such factors as the skill of the worker; the size, type, and location of the eating place; and the general tipping habits of the community. Bus boys and girls, who ordinarily do not receive tips, are often paid slightly higher wages than the waiters and waitresses they assist.

Data on union wage rates for waiters and waitresses, taken from a relatively small number of union contracts in several large cities, indicate that wages (exclusive of tips) ranged from about \$6 a day in Chicago to about \$10 a day in San Francisco in late 1956. Wages in many other restaurants, particularly in smaller cities and towns, were considerably less.

Although many waiters and waitresses work 48 hours or more a week, some ordinarily work a 40-hour week. Split shifts—which involve working for several hours serving one meal, taking some time off, and then returning to serve the next meal—is a common working arrangement for many dining room employees. Many eating places furnish meals—either free or at a low cost—and may also provide uniforms. Although the modern dining room is a pleasant place in which to work, waiters and waitresses are on their feet for hours at a time and often have to carry heavy trays.

The principal union which organizes waiters and waitresses is the Hotel and Restaurant Employees and Bartenders International Union.

Cooks and Chefs

(D. O. T. 2-26)

Nature of Work

Cooks and chefs in restaurants are responsible for the preparation of food in large quantities. The cooking skills required and the kinds of dishes prepared vary by size and type of restaurant. In large and exclusive restaurants, several cooks may be employed, each a specialist in preparing a particular type of food—soups, meats, vegetables, sauces, pastries, or ice cream. The head cook or chef supervises the staff of cooks and kitchen helpers and has overall responsibility for all food prepared. In addition, he helps train other cooks, estimates food consumption (in order to assist managers in making food purchases, planning, and pricing menus), creates new dishes, and decides on the size of food portions. On the other hand, in a small restaurant, 1 cook, perhaps assisted by 1 or 2 helpers, may prepare all the food. In inexpensive eating places, menus may have little variety and the work of cooks is likely to be standardized and involve the preparation of only a limited number of dishes. For example, "short order" cooks in inexpensive restaurants may prepare mainly ready-to-cook food—hamburgers, minute-steaks and french fries.

To assist cooks, many large restaurants employ pantrymen or salad makers who prepare and mix ingredients for salads, certain desserts, and some other types of food. The dishwashers and other kitchen helpers employed in most restaurants also perform a variety of duties incidental to food preparation. They may lift heavy loads of foodstuffs, peel potatoes and other vegetables, wash dishes, clean pots and pans, dispose of trash and garbage, and otherwise help to keep the kitchen clean and sanitary. In this work, they often use mechanical kitchen devices, such as vegetable cutters and peelers and large automatic machines, such as dishwashers.

Where Employed

Approximately 300,000 cooks, about half of them women, were employed in 1955 in establishments which were primarily eating places. In addition, about 40,000 cooks—the majority of whom are men—were employed in hotel kitchens. Many thousands of cooks were employed in institutions such as hospitals and schools, and in department stores, private clubs, aboard ships, on railroad dining cars, and in other eating places. Chefs—many of them European trained—represented less than 1 percent of all cooks employed in the Nation's eating places. Chefs are usually employed in hotels and in expensive restaurants.

Pastry cooks preparing dessert for a banquet.

Training and Other Qualifications

Cooks generally learn their trade either by informal on-the-job training or, less often, by a more formal type of apprenticeship. To become a skilled cook requires years of experience.

Although there are no formal educational requirements for becoming a cook, employers are giving increasing consideration to applicants who have taken school courses in restaurant cooking. Such courses are offered in some public vocational schools, private trade schools, and a few colleges. In addition, specialized cooking courses are sometimes given by local restaurant association groups with advice and assistance from the National Restaurant Association. These programs are particularly valuable because a major portion of the stu-

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dent's time is spent in school kitchens which are generally well equipped and skill is acquired through actual practice cooking. Courses for cooks include study in the use and care of equipment; food standards (selection, preparation, and service of food and determining the size of servings); proper sanitation procedures—including the public health aspects of food handling; cooking methods such as broiling and the use of steam; and in the preparation of special dishes, such as soups, salads and garnishes, and egg dishes such as souffles and meringues.

Experienced cooks may advance to more responsible cooking jobs in the same place of employment or may transfer to better paying jobs in other restaurants, especially if they qualify as specialists in preparing certain types of food. Promotion from cook to executive chef or head cook may take as long as 15 to 20 years; however, less time may be required, depending on the educational background and other qualifications of the person involved and the situation in the particular restaurant. The job of head cook or chef is usually filled by a man in the better restaurants. In addition to being an expert cook, a chef must have supervisory ability and a thorough knowledge of all types of foodstuffs and kitchen equipment in order to organize and direct kitchen operations efficiently. Cooks in supervisory positions may sometimes advance to managerial positions.

Cleanliness, the ability to work under pressure during peak periods, physical stamina, and a keen sense of taste and of smell are among characteristics required for the jobs of cook and chef. Health certificates which indicate that cooks are free from communicable diseases are frequently required.

Employment Outlook

The shortage of well-qualified cooks and chefs which existed in 1956 is likely to continue throughout the 1950 decade at least. Although there is always keen competition for the best jobs, there will be many employment opportunities for well-trained cooks in hotels and the better type of restaurants. An even greater number of jobs will become available for experienced, but less skilled, cooks for other kinds of restaurants. Most of the openings in all types of eating places will arise from the need to replace cooks who die, retire, or resign. Turnover is highest in low-price restaurants where many women cooks are employed.

Only a small number of openings for top positions as chefs will be available each year. However, opportunities for American-trained cooks to become chefs are expected to show continued improvement. A relatively large proportion of chefs were at, or near, retirement age in 1956 and many employers were experiencing difficulty in replacing chefs, particularly since few were available from foreign countries—the traditional hiring source.

Opportunities will probably continue to be good for cooks and chefs in institutions and other places which maintain eating facilities — hospitals, schools, department stores, industrial establishments, passenger ships, and private clubs. Young people will have many opportunities for employment in kitchen helper jobs where they sometimes gain experience helpful in qualifying as cooks.

Women will continue to find many opportunities for employment in the occupation. Although men are preferred for cooking jobs in the higher price restaurants, the proportion of women employed as cooks has been increasing steadily. Moreover, a majority of the institutional cooking jobs in places such as hospitals and schools are held by women.

In the long run, employment of cooks and chefs is expected to increase with the growth of the restaurant industry and closely related businesses. (See introductory section of this chapter.)

Earnings and Working Conditions

Experienced cooks received weekly wages ranging from about $50 to $80 in 1955 in large cities. Earnings of pantrymen, dishwashers and other kitchen workers are considerably less than those of cooks. The highest pay is received by head cooks or chefs. Chefs generally earn from $5,000 to $10,000 annually, and some whose reputations are well known receive more than $25,000 a year. As a rule, cooks' salaries are closely related to the type of eating place in which they are employed. For example, short-order cooks in low-price diners and luncheonettes generally earn less than cooks in medium-price or expensive restaurants, and cooks' earnings are usually highest in hotel restaurants. Earnings also vary by geographic location. For example, male dinner cooks employed in hotel restaurants in Boston, Philadelphia, Chicago, Cleveland, and San Francisco received aver-

age earnings of more than $2 an hour in 1955; those employed in Buffalo and Pittsburgh received $1.75; and those in some southern cities received less than $1.50 an hour.

Although some cooks and chefs work a 40-hour week, many regularly work 48 hours or more. Cooks and kitchen workers generally receive free or low-cost meals and, sometimes, are furnished uniforms that are needed on the job.

Modern kitchens in many hotels and in some other large restaurants are scientifically arranged, air conditioned, and furnished with the latest equipment and laborsaving devices. On the other hand, in some of the smaller eating places, working conditions may be less desirable. The work hazards involved include the possibility of burns from steam or hot stoves and injuries from knives and broken glass or china. Furthermore, cooks and their helpers are frequently required to lift heavy supplies and utensils.

The principal union which organizes chefs, cooks, and other kitchen workers is the Hotel and Restaurant Employees and Bartenders International Union.

Restaurant Managers and Assistants

(D. O. T. 0–71.21 through .23)

Nature of Work

Restaurant managers have overall responsibility for the operation of establishments which serve food to the public. They coordinate and direct the work of cooks, chefs, kitchen helpers, waiters, waitresses, and other restaurant employees to insure that food is properly prepared and served. Managers also direct such activities as hiring and training personnel, purchasing food and kitchen equipment, keeping cost accounts, taking inventories, approving menus, and seeing that health and sanitation regulations are observed. In addition, their work usually involves frequent contacts with customers—to establish a friendly atmosphere, get their suggestions on food and service, or handle complaints.

In a large restaurant, the manager may have several assistants including a head cook or chef, headwaiter, and dietitian. An increasing number of very large restaurants employ specially trained assistants—often called food managers—to supervise the kitchen staff and be responsible for all food preparation. Many small restaurants are managed by their owners or by a paid assistant who may also help out on various jobs; for example, he may act as cashier and even take customers' orders during busy periods.

Where Employed

Approximately 70,000 restaurant managers, excluding proprietors, were employed in 1950 in eating and drinking establishments. Almost 30 percent of these managers were women. In addition, thousands of managers were employed in dining rooms and other eating places in hotels, department stores, factories, schools, hospitals, private clubs, and other types of establishments.

Although opportunities for managers exist in cities and towns of all sizes, the greatest number of large restaurants and, therefore, most managerial positions are to be found in big cities. Some large eating places which employ managers are located in remote resort areas and on main highways.

Training and Other Qualifications

People usually become managers in one of two general ways. They may start in a job such as cook or waiter and work their way up, or they may enter directly as executive trainees. In either case, several years of experience in restaurant work are necessary to qualify as a manager, though persons with a good education may advance more rapidly than those without this background.

In a large restaurant, the promotion ladder for restaurant workers with kitchen experience may be from a minor supervisory position—such as pantry supervisor—to food manager, then to assistant manager, and later to restaurant manager; top administrative positions as executives in restaurant chains may also be attained. Similar advancement is possible for dining room workers who have a knowledge of kitchen operations. Experience in all aspects of restaurant work is important, since managers must be familiar with the duties performed and the equipment used by all the workers engaged in food preparation and serv-

ice. They also must be able to apply their knowledge about food to such matters as purchase, storage, inventory, and cost control. Poise, self-confidence, and the ability to get along with people are desirable personal characteristics for restaurant managers.

Although no specific educational requirements exist for restaurant managers, employers in the larger and more expensive establishments are showing an increasing preference for college graduates. The work-and-study programs offered by the few colleges which have specialized 4-year curriculums in institutional, restaurant, and hotel management are generally recognized as the best educational preparation. The curriculum usually includes preliminary and advanced courses in food preparation; specialized courses in restaurant accounting, catering, management, and sanitation; and more general courses such as economics, law, marketing, and finance. Another requirement for a degree in these schools is three summers of work in restaurant or hotel jobs—ranging from busboy, food checker, and waiter to dining room captain and assistant restaurant manager. The valuable experience and contacts with employers thus obtained are often of assistance in obtaining desirable trainee or other restaurant positions after graduation. Individuals who enter restaurant work with this combination of education and experience are usually advanced to managerial positions within 5 years.

College graduates with less specialized training—especially those with degrees in business administration—may also be hired as executive trainees. They usually receive on-the-job training by rotating through all phases of restaurant work. Some trainees go through an industry-sponsored program of "executive apprenticeship" under which participating restaurants cooperate with the National Restaurant Association in preparing employees for management positions.

Employment Outlook

Opportunities for well-qualified people to become managers of restaurants and hotel dining rooms are expected to continue good throughout the remainder of the 1950 decade. In 1956, college graduates with training in food management were in demand for jobs offering good possibilities of promotion. There were also good opportunities for experienced restaurant employees with outstanding qualifications to move up through the ranks to managerial positions.

The largest proportion of openings will continue to arise from the need to replace managers who die, retire, or resign. However, a number of jobs will result from the establishment of new restaurants. In addition, some assistant manager jobs will become vacant as a result of promotions to top managerial posts. The expansion of existing dining facilities—especially in large hotels—will also create new positions for assistant managers. Students seeking on-the-job experience in restaurants will have good chances for employment, particularly in summer jobs in resort areas.

In the long run, a gradual increase in employment of managers is expected, as the restaurant business continues to expand. Opportunities will arise not only in establishments that serve food as their principal activity but also in institutions and other places where large numbers of people are served meals. The best opportunities will be for men with specialized education in food management who have the experience necessary to manage a large restaurant. There will also be many opportunities, in both the short and long run, for experienced people with business ability and the necessary capital, to establish and manage their own restaurants. However, operating one's own restaurant involves considerable risk of financial loss until the business is firmly established. (See introduction to this chapter for further information on employment outlook in the restaurant business.)

Earnings and Working Conditions

Beginning salaries were $3,600 a year or more in 1956 for management trainees who had graduated from one of the few colleges with specialized restaurant management programs. College graduates with several years of restaurant experience generally earned between $6,000 and $10,000 annually in managerial positions in restaurants and hotel dining rooms. Managers' salaries, which vary considerably by size and type of establishment, are generally highest in large or exclusive restaurants. In addition to salary, some restaurants give annual bonuses to their managers.

Salaried managers usually work 40 or 48 hours a week. People who own and manage their own

restaurants often work longer hours. Generally, the evening hours worked by restaurant managers depend on the type of restaurant. For example, in city cafeterias which close shortly after most of the workers in nearby businesses have gone home, managers may have little or no evening work. On the other hand, in hotel and other restaurants which serve late dinners, managers work mainly in the evening. Managers usually receive free meals during the hours they are on duty. In large restaurants, managers may be covered by pension, insurance, hospitalization, and surgical plans.

Managers work in clean and, often, air-conditioned places. In large restaurants, they usually have their own office space. During mealtime periods, managers often walk about their establishments to check on the efficiency of operations. Managers in small establishments usually are on their feet for longer periods, since they have more direct supervision of kitchen and dining room workers than managers in larger restaurants.

TELEPHONE OCCUPATIONS

The Telephone Industry and Its Workers

About 200 million telephone calls are made in the United States in an average day. Making connections for these calls, installing new equipment and keeping existing equipment in good working order, and performing the many functions necessary for running a large and complicated business required more than three-quarters of a million telephone company employees in late 1956. The industry offers young persons many employment opportunities for steady, year-round work in a variety of jobs in communities throughout the Nation. Women comprise more than three-fifths of the industry's work force.

Nature and Location of the Industry

Providing telephone service for the many millions of residential, commercial, and industrial customers is the main work of the Nation's telephone companies. In late 1956, more than 60 million telephones were in use in the United States. More than four-fifths of the telephones are operated by the associated companies of the Bell System. The rest are operated by almost 4,800 independent telephone companies. Although most of these companies are small and are located in rural areas, at least 1 company has affiliates in 30 States. Except in those few instances where lines of the independent companies do not tie in with those of the Bell System, telephone connections may be made between any two points in the Nation.

In addition to providing telephone service, the telephone industry is engaged in other communication activities. A vast network of cables and radio-relay systems, built and maintained by the telephone industry, join the many hundreds of television and radio stations all over the Nation. These services are sold to the networks and their affiliated stations. Telephone companies also operate teletype and private-wire services which they lease to business and government offices.

Telephone jobs are found in almost every community in the United States. However, most telephone workers are employed in metropolitan areas in which population and industrial and business establishments are concentrated. Over three-fifths of them have jobs in the 10 most heavily populated States: New York, California, Illinois, Pennsylvania, Ohio, Texas, Michigan, Massachusetts, New Jersey, and Missouri.

A brief description of how the telephone system operates may provide the reader a background for understanding the various jobs in the industry. The central office, containing the switchboard equipment through which any telephone may be connected with any other telephone, is the nerve center of the local telephone company. Each time a telephone call is made, it travels from the caller through telephone wires and cables to the cable vault in the basement of the central office. From the cable vault, thousands of pairs of wires fan out to a distributing frame where each set of wires is attached to either a switchboard or dial equipment. In order to join the caller's telephone to the telephone he is calling, connections are made on this frame manually by an operator or automatically by dial equipment. Calls outside the area served by the central office are routed through cables to other central offices and then to the receiving party's line.

In late 1956, more than 200 million miles of wire were required to make connections among the many millions of telephones in operation. More than 95 percent of this wire was in the form of telephone cables which are made up of groups of individual wires. The largest cables may contain as many as 2,000 pairs of wires. In order to prevent damage to the wires, the cable is encased in lead or plastic covering. Much of this cable is strung on poles along with open wires. In large cities, most of the telephone cables are placed underground in conduits. Over long distances, such as from city to city, the cable is frequently buried below the ground where it is safe from damage.

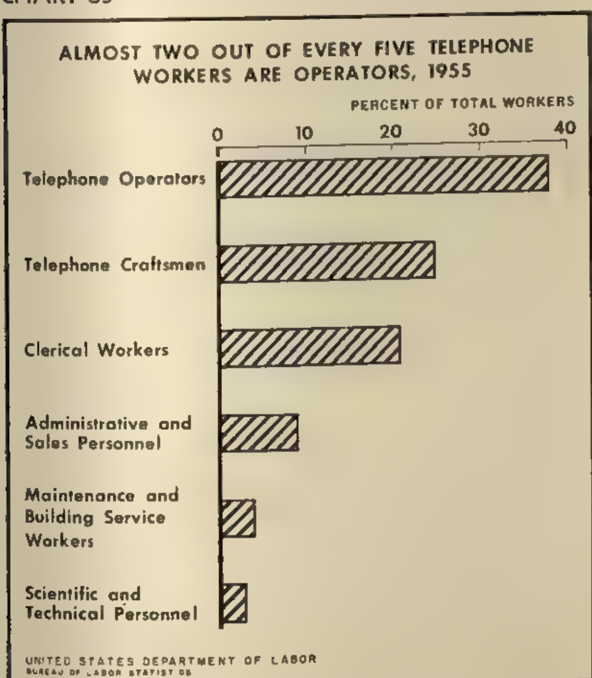
Some telephone users make and receive so many calls that they cannot be handled on a single telephone line. To take care of these calls, a system somewhat similar to a miniature central office may be installed on the subscriber's premises. This

system is the private branch exchange (PBX) usually found in apartment houses, hotels, office buildings, and factories. Other special services provided by telephone companies include conference equipment installed at a PBX to permit conversations among several telephones simultaneously, mobile radiotelephone units in automobiles, teletype machines in government or business offices, and telephones equipped to answer calls automatically when no one is in and to give and take messages by recordings.

Telephone Occupations

Keeping the telephone system operating requires a great many workers in many different occupations. Chart 65 shows the percentage distribution of employment by occupational group. Telephone operators, the largest group of telephone employees, make up about 38 percent of the industry's employment. About one-fourth of the telephone workers are engaged in installing, repairing, and maintaining the telephones, wires, cables, switchboards, and other types of communications equipment. Clerical workers make up about a fifth of the telephone employees and administrative and sales personnel make up about a tenth. Engineers, scientists, and other technical personnel such as draftsmen and laboratory technicians account for over 3 percent of the industry's employment. Four percent are maintenance and custodial workers who service and repair the central office buildings, motor vehicles, and other facilities of the industry.

CHART 65



Telephone operator jobs make up one of the largest fields of employment for women. The duties of the telephone operator include making connections for callers by operating a switchboard, giving information, and rendering many other services. Included among the telephone operators are women who hold such specialized jobs as service assistants, instructors, pay-station attendants, and long-distance operators.

The telephone industry employs many skilled craftsmen to install, maintain, and repair communications equipment. These workers can be classified into three main groups: (1) The central office craftsmen who maintain and repair the equipment in central offices; (2) the line construction men who place, splice, and maintain telephone wires and cables; and (3) the installers who place, maintain, and repair telephones and private branch exchanges (PBX) in the customers' homes, offices, and other places of business.

When complex new central office equipment is purchased by a telephone company, it is installed by central office equipment installers who are skilled workers employed by the manufacturers of this equipment. Though these men are not usually employed by the individual telephone companies, they are covered in this chapter of the Handbook because their jobs are so closely connected with the Nation's telephone system. (A discussion of these workers appears at the end of this chapter.)

To handle the tremendous amount of paper work involved in the daily business operations of the telephone system, the industry employs a great number of office workers. More than a fifth of all telephone workers are employed in clerical jobs, and most of these are held by women. Included are many stenographers, typists, bookkeepers, office-machine operators, cashiers, receptionists, file clerks, accounting and auditing clerks, and payroll clerks. They keep records of the services rendered by the company, make up and send out bills to customers, and prepare a variety of statements and statistical reports.

Almost 10 percent of telephone employment is made up of administrative and sales personnel.

These employees include such specialized workers as accountants, attorneys, personnel officers, purchasing agents, tax agents, statisticians, and training specialists.

The telephone industry employs a considerable number of scientific and technical personnel including about 20,000 engineers, draftsmen, and engineering aids. These employees are engaged in planning, designing, and constructing new facilities and in solving the engineering problems that arise in the day-to-day operations of the telephone system. Other engineers are employed in sales development work. Many of the top supervisory and administrative jobs are held by persons with an engineering background. (A detailed discussion of the duties, training, and employment opportunities in the engineering field appears elsewhere in this Handbook. See index.)

About 4 percent of the telephone industry's workers are engaged in maintaining buildings, offices, and warehouses; in operating and servicing motor vehicles; and in other service jobs in offices and plants. Skilled maintenance workers include stationary engineers, carpenters, painters, electricians, and plumbers. Other maintenance and custodial workers employed by the telephone industry are janitors, porters, watchmen, elevator operators, and guards. The duties, training and other qualifications, employment outlook, and earnings of the principal telephone occupations—central office repairmen, installers, linemen and cable splicers, and telephone operators—are discussed at the end of this chapter.

Employment Outlook

Many thousands of new workers will be hired by the telephone companies during the late 1950's and the 1960's. Most job openings will arise as a result of replacement needs. The growth of the industry will also provide a considerable number of openings. Although total employment will increase, there will be variations in the rate of growth of different job groups.

Since 1877, when telephones were first used on a commercial basis, the industry has grown rapidly. In the first three decades of the 20th century, the number of telephones in use grew steadily from 1 million to 20 million. During the depression, many people were forced to cut back their spending, and the number of telephones in use declined to about 17 million by 1933. In the late 1930's, however, the industry again resumed its upward trend and by 1940, there were 22 million telephones in use. Expansion during World War II was severely restricted by a shortage of manpower and materials and an unsatisfied demand for new telephone service accumulated. In the postwar period, telephones were installed at an unprecedented rate. Over 32 million new telephones were added, bringing the total in use to 60 million by late 1956. The number of telephones in use more than doubled from the end of World War II to late 1956.

Employment in the telephone industry has also expanded rapidly. However, the number of workers has not increased at the same rate nor at the same time as the number of telephones in use because of technological changes in the industry and the irregular programs in the expansion of facilities. From only a few thousand workers in the beginning of the century, the industry's employment grew to more than 400,000 in 1929. As more dial equipment was put into service and as depressed business conditions led to a decline in telephone use, employment dropped to less than 300,000 in 1935. Although employment grew each year after 1935, it was not until 1945 that employment exceeded the 1929 level.

In the years directly following World War II, employment rose sharply as the industry carried out a huge program of building new facilities and installing phones to meet pent-up demand. Between 1945 and 1948, employment increased almost 50 percent. Since then, employment has continued to increase, but at a slower rate. In late 1956, the industry employed more than three-quarters of a million workers.

During the late 1950's and the 1960's, it is expected that the number of telephones in use will continue to increase steadily—at the 1950–55 rate of about 5 percent per year. This expansion will result partly from the increase in population and number of family units as well as the growing number of business and industrial establishments. The 14 million households in the United States still without telephones will be another important factor in the demand for increased services. Other indications of future expansion include the trend toward using more than one telephone in private homes; the widespread installation of out-

door public telephone booths; and the increasing demand for special equipment, such as telephones in different colors, dials that are visible in the dark, and volume controls to compensate for impaired hearing.

Employment in the telephone industry is also expected to grow—but at a much slower rate than the number of telephones in use. As in the past, the industry will be able to provide an increasing volume of service per employee as a result of continued technological improvements. Both the expansion of the industry and technological changes will affect differently the employment outlook of the various occupational groups. (Discussions of the employment for some of the large telephone occupations are presented later in this chapter.)

Although the continued expansion of telephone service will create some openings for telephone workers, replacement needs will be the major source of job openings, resulting in thousands of new job openings each year. Most openings for telephone operator jobs and for some office jobs will result from a relatively high turnover rate for these workers. A large proportion of these jobs are filled by young women, many of whom stop work when they marry. Other women who are married quit work to raise a family.

Earnings and Working Conditions

Earnings data for two large groups of telephone workers are collected each month by the U. S. Department of Labor's Bureau of Labor Statistics.

In December 1956, one group—switchboard operating workers—had average weekly earnings of $60.92 and their hourly earnings averaged $1.66. The second group, nonsupervisory central office craftsmen, installers and repairmen, linemen and cable splicers, and their helpers, together averaged $104.01 a week, and their average hourly earnings were $2.38 during the same period.

Many telephone workers are members of unions. Most of these workers are represented by the Communications Workers of America, but some are members of independent unions or the International Brotherhood of Electrical Workers.

Pay rates and progression from the minimum or starting rates are usually governed by well-defined schedules set forth in labor-management agreements. These schedules stipulate the amount of time required to move from one step to another as well as the weekly wage increase accompanying each step upward. Usually, pay increases in craft and operating jobs are given every 3 or 4 months for the first year or 2 and then every 6 months until the top of the grade is reached in about 6 years.

Generally, telephone companies' union contracts call for premium pay for work in excess of 8 hours a day or 40 hours a week and for all Sunday work. Most contracts also provide that the rate of pay for nightwork shall be 5 or 10 percent above the basic day rate. Overtime work is sometimes required in the telephone industry especially during emergencies, such as floods, hurricanes, or bad storms. During an "emergency callout," which is a short-notice request to report to work during nonscheduled hours, the worker generally is guaranteed a minimum of 3 or 4 hours' pay at his basic hourly rate, and travel time to and from the job is counted as worktime.

In addition to these provisions which affect the pay envelope directly, other benefits are provided by the telephone companies. Periods of annual vacations are granted to workers according to length of service. Usually, contracts provide for a 1-week vacation for 6 months to 1 year of service, 2 weeks for 1 to 15 years, and 3 weeks for over 15 years of service. The number of paid holidays varies from 6 to 11 days a year depending on locality. Nearly all companies have sick leave provisions for their employees. A typical program provides that payments for sick leave up to 7 days be paid to employees with at least 2 years of service. Provisions for sick leave beyond 7 days are covered in benefit plans adopted by most companies. The majority of the telephone workers are covered by group insurance plans which usually include sickness and accident insurance and retirement and disability pensions.

The telephone industry has achieved one of the best safety records in American industry. The injury-frequency rate in the telephone industry was the lowest among all the industries surveyed in 1955 by the Bureau of Labor Statistics. For each million man-hours worked in the industry in 1955, only 0.9 disabling injury occurred. For all manufacturing, the injury- frequency rate was 12.1.

Where To Go for More Information

Additional information about jobs in the telephone industry can be obtained from the local telephone company or from local unions with telephone workers among their membership. If no local union is listed in the telephone directory, information may be obtained from the following:

Communication Workers of America,
1808 Adams Mill Rd. NW., Washington 9, D. C.

International Brotherhood of Electric Workers,
1200 15th St. NW., Washington 5, D. C.

Central Office Craftsmen

Nature of Work

In late 1956, the telephone companies employed about 66,000 central office craftsmen to test, maintain, and repair the manual and dial central office equipment. The central office craftsmen group is composed of several occupations with different skill levels. These individual occupations are described below.

One of the primary duties of central office craftsmen is preventive maintenance; that is, locating and eliminating potential trouble spots before they become serious enough to interfere with service. Periodic tests are made on all central office equipment to keep it in good operating condition. Another important function of some central office craftsmen is to help locate and analyze trouble spots on customers' lines by using special testing equipment located in the central offices.

Framemen (D. O. T. 7–53.020). The job of frameman is usually the beginning job from which a worker may advance to the more skilled central office crafts jobs. Under the direction of central office foremen, framemen work at the distributing frames or panels where thousands of pairs of wires come in from lines and cables. In large central offices, these frames may be as large as two stories high and half a block long. Framemen string wires to the proper terminals on the frames and then solder the connections. This work requires some manual dexterity in making connections with small wires. Connections are made according to worksheets prepared by other specialized personnel or by oral directions of the testboardmen.

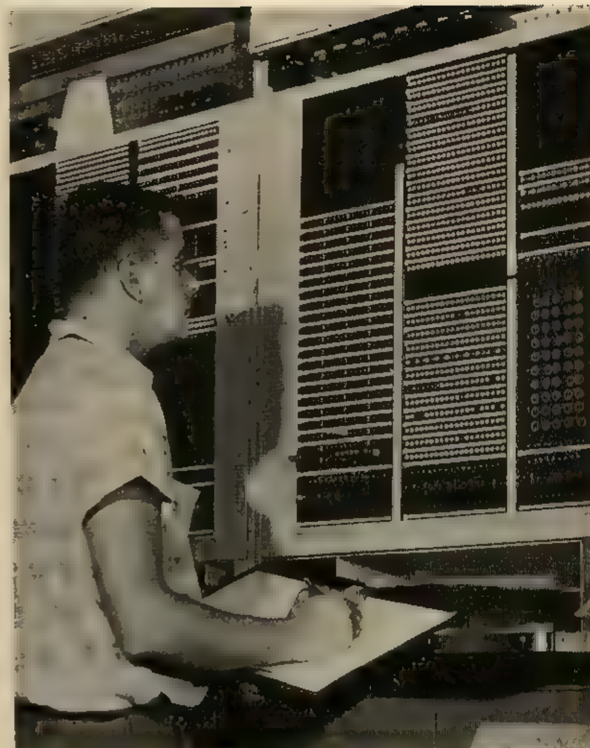
Framemen connect the thousands of pairs of wire that come into the central office from lines and cables.

Central office repairmen (D. O. T. 5–53.235). These workers, often called "switchmen," are responsible for the maintenance and repair of the circuits and equipment in the central office. These repairmen check the central office apparatus, switches, and relays, using special tools and gages and their knowledge of circuit operations. They make repairs and precision adjustments as necessary. They also locate and repair trouble spots which are reported to them by the testboardmen. These workers are sometimes designated according to the type of central office equipment they re-

pair, such as *manual-equipment repairmen* or *dial office switchmen*. In late 1956, the telephone industry employed over 39,000 central office repairmen, helpers, and framemen.

Testboardmen (D. O. T. 5–53.310). These workers help keep services operating efficiently by testing for and analyzing trouble spots reported on customers' lines. Working at special switchboards made up of electrical testing instruments, these workers determine the cause and location of the reported trouble. They then report the nature of the trouble either to the line and cable maintenance crews or to the central office repairmen who are assigned to make repairs and restore service. Testboardmen also make periodic routine checks of lines and circuits to prevent breakdowns. In late 1956, almost 16,000 testboardmen were working in telephone companies.

Powermen (D. O. T. 5–51.510). These workers operate and maintain the motors, storage batteries, and other equipment needed to provide electrical power in central offices. Only a few powermen are required even in large central offices. In small plants, their duties may be assigned to a central office repairman.



Central office repairmen record trouble spots as indicated on special panel boards.

Training, Other Qualifications, and Advancement

Telephone companies usually hire young, inexperienced men to be trained for the skilled jobs in central offices. Applicants for these jobs generally must have at least a high school education or its equivalent. A knowledge of the basic principles of electricity is helpful, though not a prerequisite. Pre-employment tests are usually given to help select prospective employees. Training and experience received in the armed services may be helpful to veterans in obtaining jobs as telephone company craftsmen.

Most telephone companies have regular programs for training new employees in central office jobs. These programs include classroom instruction as well as on-the-job training. After a training course of a few weeks, the new worker in the central office is assigned to a starting job. He usually begins as a frameman where he works alongside the skilled craftsmen under the direction of a supervisor or foreman. As the frameman

The central office equipment installer making a final check of dial switching equipment in a central office.

gains skill and experience, he may advance to central office repairman. A person assigned to a job of central office repairman generally receives additional classroom instruction lasting 6 weeks or longer. Instruction includes such courses as the principles of electricity and magnetism and fundamentals of equipment maintenance, as well as special courses on the particular type of central office equipment used by the company employing the repairman. Central office repairmen may be promoted to the job of testboardmen. In some cases, employees move directly from framemen to testboardmen. Normally, it takes at least 6 years from the time a man is first employed to reach the top step in the progression schedule as central office repairman or as testboardman.

Central office craftsmen receive training throughout their careers with the telephone company. As new types of equipment and new maintenance procedures are developed, these men are given additional training. This may consist of attending schools for short periods of instruction. Many workers move into central office jobs from other types of telephone jobs. For example, some men start out as telephone installers or as linemen and eventually transfer to jobs as central office craftsmen with additional training.

Employment Outlook

In the late 1950's and the 1960's, young men will find many opportunities for employment in central offices of telephone companies. Many of these openings will arise from the expected expansion of telephone facilities and the growing complexity of central office equipment. (See p. 600 for a discussion of the long-run outlook for the demand for telephone services.) The wider use of the dial system along with the conversion of more central offices to the automatic message accounting system will greatly increase the amount of new central office equipment in use. Many additional central office craftsmen will be needed to install, test, maintain, and repair this equipment. It is expected that central office craftsmen will be one of the faster growing groups of telephone employees. Job openings will also result from the need to replace those workers who die, retire, or leave the industry to take other jobs. Death and retirement alone are expected to create 10,000 job openings in the 1956–66 decade.

Earnings and Working Conditions

Central office craftsmen are the highest paid group of skilled workers in the telephone industry. The amount the individual earns depends on the occupation and the geographical location of his job. The following tabulation shows the average hourly earnings of testboardmen and central office repairmen, including framemen, employed by class A telephone carriers in October 1956, for the United States as a whole and by region:

Region	Testboardmen	Central office repairmen, including framemen
United States	$2.45	$2.31
New England	$2.60	$2.34
Middle Atlantic	2.80	2.45
Great Lakes	2.58	2.31
Chesapeake	2.63	2.28
Southeastern	2.45	2.16
North Central	2.52	2.41
South Central	2.49	2.40
Mountain	2.37	2.14
Pacific	2.40	2.25

Average earnings for the country as a whole of testboardmen was $2.45 an hour, and $2.31 for central office repairmen. Average hourly earnings of testboardmen ranged from $2.37 an hour in the Mountain States to $2.80 in the Middle Atlantic States. For central office repairmen, average hourly earnings ranged from $2.14 an hour in the Mountain States to $2.45 in the Middle Atlantic States.

Earnings vary considerably with length of service in central office jobs, as illustrated by the wage schedule in one city (effective 1956). According to this wage schedule, framemen start out at a basic weekly rate of $52.50 and can work up to a maximum of $94 after 5 years. At any time during this period, if a vacancy occurs and the worker is qualified, a frameman may move into the job of central office repairman or testboardman on a higher pay schedule. Central office repairmen and testboardmen can reach a maximum of $110 after 6 years of periodic increases.

Since the telephone industry gives continuous service to its customers, the operation of a central

office is a 24-hour, 7-day-a-week job. Therefore, some central office craftsmen work schedules which include evenings, nights, and weekends. Employees in central offices work under comparatively favorable conditions in clean and well-lighted surroundings. Central office craftsmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 601.)

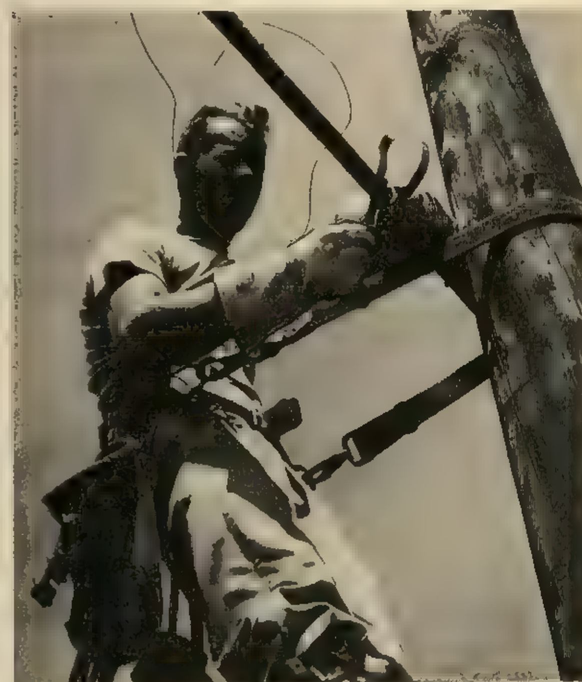
Linemen and Cable Splicers

Nature of Work

The vast network of wires and cables which connects the central offices to the millions of telephones and switchboards in customers' homes and buildings is constructed, maintained, and repaired by linemen and cable splicers and their helpers. In these operations, telephone companies employed about 22,000 linemen and 17,000 cable splicers. Almost 7,000 foremen and 9,000 cable splicers' helpers and laborers were employed in these operations in late 1956.

Linemen (D. O. T. 5-53.410). These workers place wires and cables and perform all the other tasks necessary for constructing new telephone lines and maintaining and repairing existing lines. In new line construction, they dig holes in the ground, place and tamp in telephone poles, and attach the crossarms and other fixtures that support the wires and cables. The linemen climb poles and raise and attach the wires to the insulators on the poles. They place cables on the poles, leaving the cable ends free for the cable splicer to connect later. In urban areas, they may also place cables in underground conduits. Linemen usually work in line construction crews of 2 to 5 men. A foreman directs the work of several of these crews.

Although the installation of new telephone lines is an important aspect of the job, much of the linemen's work consists of the repair and maintenance of existing lines. Linemen are sometimes assigned certain sections of lines which they inspect periodically. In connection with their inspections, they make minor repairs and line changes. When wires or cables break or when a pole is knocked down, linemen are sent immediately to make emergency repairs. The line crew foreman keeps in close contact with the testboardman who directs him to any trouble spots in the line.



Lineman on pole secures wire with a metal strap.

Cable Splicers (D. O. T. 5-53.950). After the linemen have placed the wires and cables on poles or under ground, cable splicers working on aerial platforms or in manholes connect the individual wires within the cables in such a way as to keep each circuit continuous. Cable splicers also rearrange pairs of wires within a cable whenever the lines have to be changed. At each splice location, they wrap insulation around the wires and seal the joint with a lead sleeve or other type of closure. Occasionally, they fill the sheathing with inert gas under pressure to keep moisture out. Splicing is a very responsible and exacting job; an incorrectly spliced cable can lead to a serious breakdown in telephone service for the subscribers on the line.

In addition to connecting new cable, cable splicers also maintain and repair cables. Preventive maintenance is extremely important because a single defect in a cable may result in a serious interruption in service. Many trouble

spots can be determined through electrical and gas pressure tests and measurements made from the central office testboard.

Training, Other Qualifications, and Advancement

Telephone companies hire young, inexperienced men and train them for the job of lineman or cable splicer. New employees for these skilled line and cable jobs usually must have a high school education or its equivalent. Knowledge of the basic principles of electricity is also helpful, though not a prerequisite. Preemployment tests are often given to help determine the applicant's aptitudes. Some of the line and cable work is strenuous, requiring the climbing of poles and the lifting of lines and equipment. Telephone companies look for young men with agility, good physical condition, and manual dexterity. Manual dexterity is important, particularly for cable splicers. Many young persons who have received telephone training and experience in the armed services are given preference for job openings and are brought in above the entry level. Veterans are frequently granted some credit for telephone training and experience received in the armed services.

Telephone companies have established comprehensive training programs for these jobs. New workers are given classroom instruction in addition to on-the-job training. Classrooms are equipped with actual telephone apparatus, such as poles, crossarms, and other fixtures, to simulate working conditions as much as possible. The new workers receive their initial training by learning to climb poles under close supervision. They are taught safe working practices to avoid the hazards of power wires and falls. After a short period of this training, the new lineman is assigned to a line crew and goes out in the field to work with experienced men. He continues to learn while on the job under the supervision of the line foreman. It usually takes about 6 years for the lineman to reach the top of the pay schedule.

In other cases, new men are first assigned as cable splicers' helpers. Working with experienced cable splicers under the direction of a splicing foreman, they gradually acquire all the skills of the trade. After working 3 or 4 years as a cable splicer's helper, a man may advance to cable splicer and may reach top pay for the job in another 2 or 3 years.

Line construction craftsmen continue to receive training throughout their careers with the telephone company in order to qualify for the more difficult assignments and to keep up with technological changes in the industry. Cross-training (switching workers from one job to another) provides additional advancement opportunities for workers in the telephone industry. For example, after a few years of working as a lineman, a man may be transferred to the job of central office repairman or to telephone installer and later to telephone repairman. The amount of such shifting depends on the needs of the company and the aptitude of the workers.

Employment Outlook

Employment of linemen and cable splicers is expected to increase moderately during the late 1950's and the 1960's. Replacement needs, however, will provide most of the job openings for new workers.

In order to meet the pent-up demand for new telephone services which had accumulated during World War II, telephone companies more than doubled their employment of linemen and cable splicers from 1945 to 1948. Since 1949, there has been only a small growth of employment in these occupations. The anticipated expansions in line construction will result in only a small increase in employment of these workers.

Because of the strenuous nature of the work, some linemen are unable to continue in the occupation after they reach 50 or 55 years of age. Those linemen who have not already been transferred to other crafts jobs by the time they reach their fifties are usually transferred to some less physically demanding job. Replacement needs resulting from transfers to other jobs, retirements, or deaths are expected to create about 10,000 openings during the 1956–66 decade.

Earnings and Working Conditions

Cable splicers have higher wage rates than linemen. In October 1956, cable splicers averaged $2.36 an hour and linemen averaged $1.84.

The following tabulation shows the average hourly earnings for linemen, cable splicers, and cable splicers' helpers employed by class A tele-

phone carriers in October 1956, for the United States as a whole and by region:

Region	Cable splicers	Cable splicers' helpers	Linemen
United States	$2.36	$1.43	$1.84
New England	$2.42	$1.40	$1.64
Middle Atlantic	2.52	1.36	1.87
Great Lakes	2.42	1.47	1.87
Chesapeake	2.32	1.41	1.59
Southeastern	2.25	1.45	1.68
North Central	2.09	1.49	1.75
South Central	2.46	1.64	2.14
Mountain	2.16	1.59	1.70
Pacific	2.28	1.52	1.91

Pay rates within the jobs also depend to a considerable extent upon length of service. For example, new workers in line construction jobs in one area in 1956 began at the basic weekly rate of $52.50. Linemen could reach the maximum of $107.50 after 6 years of service. Cable splicers' helpers could reach a maximum of $83.50 in less than 4 years of service. (However, at some time before reaching this maximum, many helpers are reclassified as cable splicers and are thus transferred to a new pay schedule.) The maximum basic weekly rate of cable splicers was $114.50, based upon a combined total of at least 6 years' work as a helper and as a splicer. Linemen and cable splicers are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 601.)

Linemen and cable splicers work outdoors in all kinds of weather. They must do a considerable amount of climbing. In cities, where underground cable is used, cable splicers also work in manholes under the streets. Here, considerable stooping and working in cramped positions are involved. Safety standards developed over the years by the telephone systems with the cooperation of the unions have greatly reduced the hazards of these occupations. When severe weather conditions damage telephone lines, both linemen and cable splicers may be called upon to work long and irregular hours to repair damaged equipment and to restore service.

Telephone and PBX Installers and Repairmen

Nature of Work

Telephone and PBX installers and repairmen install and service telephone and private branch exchange (PBX) equipment on subscribers' property and make necessary repairs on this equipment when trouble develops. These workers travel to the customers' premises, often driving trucks equipped with telephone tools, materials, and supplies. Since telephone customers move frequently and desire new types of service and equipment, much of the installers' work consists of relocating or making changes or additions to customers' existing equipment. For example, they may install a multiline key telephone system in a business firm or change a 2-party line to a single-party line in a residence. Installers may also answer a customer's request to add an extension in another room of a residence or to replace an old telephone with one of the newer models.

In late 1956, there were almost 79,000 telephone and PBX installers and repairmen, making this the largest group of telephone craftsmen. Over one-half of these men were engaged primarily in installing telephones or private branch exchanges. More than 14,000 were engaged in repairing and maintaining this equipment, and about 10,000 were foremen. Although the jobs of installing and repairing telephones and PBX systems are discussed below as separate jobs, many telephone companies combine two or more of these jobs.

Telephone installers (D. O. T. 5-53.030). These men install and remove telephones in homes and places of business, including coin-box telephones, switching equipment, and the associated inside wiring located on the subscribers' premises. They connect the newly installed telephones with outside service wires which they run to nearby cable terminals on buildings or poles. The installers must often climb poles in order to make these connections. Telephone installers are sometimes called *station installers.*

PBX installers (D. O. T. 5–53.020). These skilled workers perform essentially the same duties as telephone installers, but they specialize in the more complex switchboard installations. They connect wires from terminals to the switchboards and make tests to check their installations. Some of the PBX installers set up equipment for radio and television broadcasts, mobile radiotelephones, and teletypewriters.

Telephone repairmen (D. O. T. 5–53.240). With the assistance of the testboardmen in the central office, telephone repairmen locate trouble on the subscribers' telephones, associated inside wiring, and outside service wires and make the necessary repairs. Sometimes the jobs of telephone repairmen and telephone installers are combined and the workers are called *telephone installer-repairmen.*

PBX repairmen (D. O. T. 5–53.240). These men, with the assistance of testboardmen, locate trouble. Repairmen then make the necessary repairs at PBX telephone switchboards and maintain associated equipment such as batteries, relays, and power plants. Some PBX repairmen maintain equipment for radio and television broadcasts, mobile radiotelephones, and teletypewriters. They may also service other electrical signal systems, such as buzzer signals, public-address systems, and automatic-calling systems. Sometimes the jobs of the PBX installers and repairmen are combined into the job of *PBX installer-repairmen.*

Training, Other Qualifications, and Advancement

Telephone companies hire young, inexperienced men and train them for station and PBX installation and repair jobs as they do other craft jobs. Since much of the work requires contact with customers, personal appearance and the ability to meet people are important considerations for these jobs. Applicants for these skilled jobs usually must have a high school education or its equivalent. To help determine the applicants' aptitudes, preemployment tests are sometimes given.

New entrants are given classroom instruction in addition to on-the-job training. Classrooms are equipped with actual telephone apparatus to simulate working conditions as much as possible. For example, in the rooms assigned to installation training, telephone poles, cables, and terminal boxes as well as typical examples of home and office installations are set up just as they appear in the field. After a few weeks of classroom training, the new workers accompany skilled installers and learn the job by watching and helping the experienced men. It normally takes from about 3 months to a year of experience before the new workers are ready to perform installation work alone.

Telephone and PBX installers and repairmen continue to receive training throughout their careers with the telephone company in order to qualify for the more difficult and responsible assignments. Since technological changes in the telephone industry are occurring constantly, it is the practice of telephone companies to send their craftsmen to training schools from time to time for instruction as new techniques and devices are introduced. Cross-training (switching workers from one job to another) provides additional advancement opportunities for workers in the telephone industry. For example, after a few years of working as a telephone installer, a man may be transferred to the higher paying job of PBX installer. Similarly, the telephone repairman may be promoted to PBX repairman, one of the top paying jobs. In another case, a new worker may start out as a lineman and then be transferred to the job of installing and repairing telephones, later moving to either PBX installer or PBX repairman.

Employment Outlook

Employment of telephone and PBX installers and repairmen is expected to continue to increase steadily during the late 1950's and the 1960's. In this period, the number of telephones in use is expected to grow at an annual rate of about 5 percent a year. As the number of telephones in use increases, more installers and repairmen will be needed. They will be employed not only to install new telephones, but, more importantly, to service and repair existing equipment and to disconnect and hook up telephones when customers move from one place to another. This last factor has been particularly significant in recent years because of the larger number of persons and businesses moving each year. For example, in April 1956, 1 out of every 5 persons in the United States was living in a different house from the one he lived in 1 year earlier.

In addition to job openings arising from the growth of these occupations, replacement needs due to promotions, deaths, retirements, and transfers to other fields of work will also provide many job opportunities for new workers. Although a large proportion of telephone and PBX installers and repairmen are young men who were hired since World War II, there are also older men in these occupations nearing the retirement age. It is estimated that death and retirement alone will create more than 10,000 job openings in the 1956–66 decade.

Earnings and Working Conditions

In October 1956, the average hourly earnings of telephone and PBX installers and repairmen in the United States were $2.31 an hour. In the individual occupations, PBX repairmen earned $2.57 an hour and telephone and PBX installers earned $2.28. Average hourly earnings for PBX repairmen ranged from $1.87 in the Southeastern States to $2.73 in the New England States. For telephone and PBX installers, the average hourly earnings ranged from $1.65 in the Southeastern States to $2.62 in the North Central States. In October 1956, average hourly earnings of installers and repairmen in class A telephone carriers in the United States and in the various regions were as shown in the accompanying table.

Region	PBX repairmen	PBX and station installers
United States	$2.57	$2.28
New England	$2.73	$2.34
Middle Atlantic	2.64	2.42
Great Lakes	2.61	2.20
Chesapeake	2.64	2.10
Southeastern	1.87	1.65
North Central	2.62	2.62
South Central	2.53	2.42
Mountain	2.35	2.15
Pacific	2.50	2.16

Telephone companies have pay schedules in which the wage rates within each job classification increase with length of service. For example, in the 1956 wage schedule of one area, telephone installers and repairmen started with a basic weekly wage of $55 and received periodic pay increases until they reached a maximum of $109.50 after at least 6 years. PBX installers and repairmen began with the same base pay and progressed to $114.50. Installers and repairmen are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 601.)

Telephone and PBX installers and repairmen work indoors and outdoors in all kinds of weather. Outdoor work includes placing and repairing the wires leading from telephone poles to the customers' premises. Climbing poles is a necessary part of the installers' job. The work of installers and repairmen brings them in contact with the public since they work in the subscribers' homes and places of business. These workers are subject to emergency callouts in case of breakdowns in customers' lines or equipment.

Telephone Operators

(D. O. T. 1–42.00 through 1–42.09)

Nature of Work

Telephone operators make up the largest group of workers in the telephone industry. The job of the telephone operator constitutes one of the larger fields of work for women. Telephone companies employed more than a quarter million women in the various telephone operating jobs in 1956. The principal duty of most operators is to make connections for calls by placing plugs in the proper jacks or "receptacles" on switchboards, and to provide information or assistance to customers or other operators. There are a number of specialized operating jobs. Among such jobs are *long-distance operators* who assist callers in completing long-distance calls. They make connections necessary to reach distant points and record necessary data about the calls. *Information operators* service customers' and long-distance operators' requests for telephone numbers by referring to indexes, bulletins, or files which list subscribers by name and by address. *Dial-service assistance operators* provide special services to customers in dial offices by assisting them in placing and completing their calls.

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Long distance operators push buttons to make calls to telephones in distant cities without help from operators along the way.

Operators generally work in groups of from 6 to 15 led by a service assistant. The *service assistant* coordinates the activities on her section of the switchboard, checks operators in and out of their positions according to schedules, and assists operators with unusual or emergency calls. She conducts initial training classes, continues follow-up training of newly assigned operators, and observes and checks the work of the operators.

The *chief operator* is responsible for planning and directing the activities involved in the operation of switchboards. She oversees personnel matters such as hiring, training, and transferring of employees. She is assisted in her work by *assistant chief operators* and *central office clerks.*

Training, Other Qualifications, and Advancement

High school graduates between the ages of 18 and 25 are usually preferred for operators' jobs. Good eyesight and good hearing are always required and are carefully checked during the physical examination. In addition, the applicant is usually given a spelling, arithmetic, and learning ability test. A pleasing voice, alertness, manual dexterity, legible penmanship, a sense of teamwork for cooperating with other operators in establishing connections, and a stable disposition are the main personal qualifications for the job of operator.

A group of 2 or 3 new employees is generally assigned to an instructor (usually the service assistant) who teaches them on an individual basis for a period of 2 to 5 weeks. Training consists of discussions of procedures, handling controlled practice calls, and drills. With coaching and close supervision, the trainee practices handling the most common types of calls on dummy switchboards to develop skill and speed. After learning the fundamentals of common types of calls through this type of training, she is assigned to a regular position at the switchboard.

Further training and instruction are given to the operator periodically so that she may develop maximum skill in handling the other switchboard positions. The service assistant continues to coach her in special procedures in the different switchboard positions such as long-distance, information, and other operating services. The general policy of telephone companies is to have a flexible force of operators capable of working at a number of positions in the central office. To build up a force of all-round operators, cross-training on different kinds of work is necessary. Changes in the methods of handling calls and installations of new central office equipment make it necessary for operators to receive additional training throughout their careers.

A switchboard operator may be promoted to the job of service assistant which requires a thorough knowledge of all operating practices and the ability to instruct, check, and work harmoniously with her group. In most of the larger central offices, the job of assistant chief operator is the next step in advancement for service assistants. The job of chief operator is usually the highest level to which telephone operators may advance within a central office.

Other jobs to which an experienced operator may advance are the clerical jobs in the central office or in the traffic department's administrative office. These clerical jobs are usually filled by recruiting from the operating staff since the knowledge of operating procedures is useful in this work. Central office clerks assist the chief operator in her clerical duties, and administrative clerks prepare reports for managing and planning the work of the traffic department. One job in the administrative office to which a service assistant or a service observer may advance is that of the PBX instructor. She insures good service on customers' PBX boards by teaching the customers'

employees how to operate their PBX boards most efficiently. Frequently, qualified operators have opportunities to transfer to jobs in other departments, as, for example, service representative in the business office.

Employment Outlook

There will be a great many opportunities for young women to enter this occupation during the late 1950's and the 1960's although relatively little change in the total number of telephone operators is expected. New employees will be hired primarily to fill jobs resulting from the high rate of turnover. A large proportion of these jobs are filled by young women who remain in the industry for only a few years. It is estimated that from 1950 to 1955, the telephone industry hired an average of 100,000 new operator trainees each year, primarily to fill the jobs of operators who had left their employ. Large numbers will be needed each year during the next decade.

After rising sharply during the World War II period, the number of operators employed by telephone companies has remained fairly stable. From 1940 to 1946, employment of operators doubled, increasing from about 135,000 to 270,000. In the post-World War II period, a tremendous quantity of new automatic equipment was installed in telephone central offices, considerably lessening the workload placed on operators. Although the number of phones in use grew almost 100 percent from 1946 through 1956, the employment of telephone operators remained fairly stable. It is estimated that the number of new telephones in use will increase at a rate of about 5 percent per year during the 1956–66 decade. However, continued technological advances will enable the industry to handle the increased amount of service with little change in the number of telephone operators employed.

Among technological developments affecting the employment of telephone operators are the extension of dial systems in long-distance service, the conversion of the remaining manual local systems to dial service, and the increased use of automatic timing and recording devices. However, it must be emphasized that even with automatic telephone procedures, large numbers of operators will still be needed. Many types of calls, such as information calls, some calls from coin telephones, person-to-person calls, and reverse-charge calls, cannot be handled without the assistance of an operator.

Earnings and Working Conditions

Telephone companies reporting to the Bureau of Labor Statistics showed that average weekly earnings of telephone operating employees were $60.92 for a workweek of 36.7 hours, or about $1.66 an hour in December 1956.

The following tabulation indicates the wide range of earnings among the different operating categories in class A telephone carriers in October 1956:

Chief operators	$2. 43
Service assistants and instructors	1. 89
Experienced telephone operators	1. 55
Operator trainees	1. 24

Pay rates for telephone operators also vary somewhat by locality. The following tabulation shows the hourly earnings of experienced telephone operators in class A telephone carriers in October 1956 in the United States and various regions of the country:

United States	$1. 55
New England	1. 59
Middle Atlantic	1. 67
Great Lakes	1. 63
Chesapeake	1. 49
Southeastern	1. 31
North Central	1. 43
South Central	1. 43
Mountain	1. 43
Pacific	1. 68

Earnings of telephone operators increase considerably as the employee gains experience and skill. For example, under the 1956 wage schedule of one city, telephone operators start out at a basic weekly rate of $52.50 and received periodic increases to a maximum of $69.30 after a period of at least 6 years. Service assistants receive $9.50 a week above the operator schedule rates. Evening and night differentials are paid to operators whose tours of duty end after 7:30 p. m. They range from 40 to 80 cents extra pay for each evening worked. Operators who work on all-night tours of duty receive an extra $1.20 for each night worked. Telephone operators are covered by the same provisions governing overtime pay, vacations, holidays, and other benefits that apply to telephone workers generally. (See p. 601.)

The rooms where the telephone operators work

are generally well lighted and well ventilated. Adjustable seats are provided for the operators. However, workrooms are rather confining and the headsets may become uncomfortable, especially in the summer in buildings without air conditioning. Most companies provide pleasant, attractive lounges for operators to relax in during rest periods. Many of the larger central offices also have cafeterias where inexpensive hot foods and drinks are served throughout the day.

Since the telephone industry gives continuous service at all hours every day in the year, many operators work night and evening hours, Sundays, and holidays. However, the basic work week is 40 hours. Many operators work split shifts in order to handle the peak calling loads in late morning and early evening hours. For example, an operator may have a tour of duty from 8 a. m. to noon and from 4 p. m. to 8 p. m. Because seniority usually determines the selection of tours, new workers are most likely to be assigned to split shifts. Telephone operators are also subject to emergency callouts although this happens very rarely.

Central Office Equipment Installers

(D. O. T. 5–53.010)

Nature of Work

Most of today's central office switching and dialing equipment is so large and complex that it cannot be moved into a telephone exchange in complete units. It must be manufactured and installed section by section. Central office equipment installers make these installations on the premises of the local telephone companies. They assemble, wire, and test the complex array of equipment in locations designated in floor plans, making sure that the central office equipment, which is the heart of the telephone system, conforms to the manufacturer's standards to provide efficient and dependable service. Installation jobs may involve equipping a new central office, installing additional units in an expanding local office, or replacing outmoded equipment with new types of equipment.

Central office equipment installers are not employed by the telephone companies but by the manufacturers of telephone equipment. Most installers work for one large manufacturing company which provides and installs central office and private branch equipment for the associated companies. A few smaller firms manufacture and install equipment for many of the independent companies.

The central office equipment installers employed by these companies are required to travel to the various telephone offices within their assigned areas. Although these areas may cover several States, their work is usually located in or near the larger cities in which they reside. On small jobs, such as installing a switchboard in a small community, an installer may be teamed with only 1 or 2 other installers. However, when a long distance toll center is to be installed in a big city, he may work with hundreds of other installers.

Training, Other Qualifications, and Advancement

Employers usually require applicants for jobs as installers to have a high school education or its equivalent. Men with some college education are often hired for jobs as installers. They have some advantage in competing for advancement within the company, especially if they have engineering training. It is absolutely necessary that the applicant be willing to travel. Preemployment tests are generally given to determine the applicant's aptitudes.

The new employee receives on-the-job training supplemented by classroom instruction. He usually attends classes for the first few weeks to learn the basic operations of installation. After this short period, the installer is assigned to a supervisor and starts his on-the-job training working with experienced installers. After several years of experience, he qualifies as a skilled installer. Training on the job, however, continues even after he has become a skilled worker. Technical courses are given from time to time to improve the skill of the experienced installer and to train him on new equipment and techniques.

Employment Outlook

The development and installation of new types of telephone equipment and the general expansion

of telephone service are expected to result in a moderate increase in employment of installers during the late 1950's and the 1960's. Openings will also arise from deaths, retirements, promotions, and movements out of the occupation.

A tremendous postwar expansion in central office facilities of telephone systems all over the country resulted in a rapid rise in the employment of installers. The employment of installers by the chief manufacturer of telephone equipment illustrates the growth in this occupation. By 1947, the number of installers employed by this company had grown to more than 25,000 compared with a prewar peak of 11,500 in 1941. As the backlog of requirements for the installation of new or additional central office equipment was reduced, there was a gradual decrease in the number of central office installers so that by the end of 1950, the company employed 10,000 of these workers. Since that time, employment has been increasing steadily, reaching about 18,000 in mid-1956. The development and increased use of new types of telephone equipment, such as long-distance dialing facilities and microwave stations, as well as the need to modernize existing central office equipment are expected to result in a moderate increase in the employment of installers in the late 1950's and the 1960's.

Earnings and Working Conditions

Installers earn \$1.39 or \$1.46 an hour, depending on locality, according to the major union contract of August 1956. The contract provides for periodic increases until the employee reaches a rate of \$2.26 or \$2.38 an hour after 5½ years of experience. Employees may also receive merit increases above these maximum rates. Time and a half is paid for work in excess of 8 hours a day or 40 hours a week, and double time is paid for work on Sundays or holidays. A majority of the installers are granted 7 holidays a year. Vacations are granted according to length of service. A worker with 1 year of service receives 1 week's vacation; 2 to 15 years of service, 2 weeks; and over 15 years of service, 3 weeks. Most central office equipment installers are represented by the Communication Workers of America.

Agricultural Occupations *

The general outlook for farming in the years ahead is obscured by doubts whether rising farm output will continue to exceed demand. The current situation is partly indicated by the course of prices received and paid by farmers (chart 66). The adverse parity relationship in recent years principally reflects the pressure of surplus supplies of farm products. Parity is defined as the relationship between prices received and paid by farmers that will give farm commodities the same buying power that they had in the period 1910–14, when prices received and paid were considered to be in good balance. Rapid technological progress has kept agricultural production running ahead of market outlets despite the upward surge in population. Unlike many other segments of the economy, agriculture cannot anticipate any general increase in per capita consumption of its products. Expansion of markets will depend mainly on growth of the population.

*Prepared by the U. S. Department of Agriculture.

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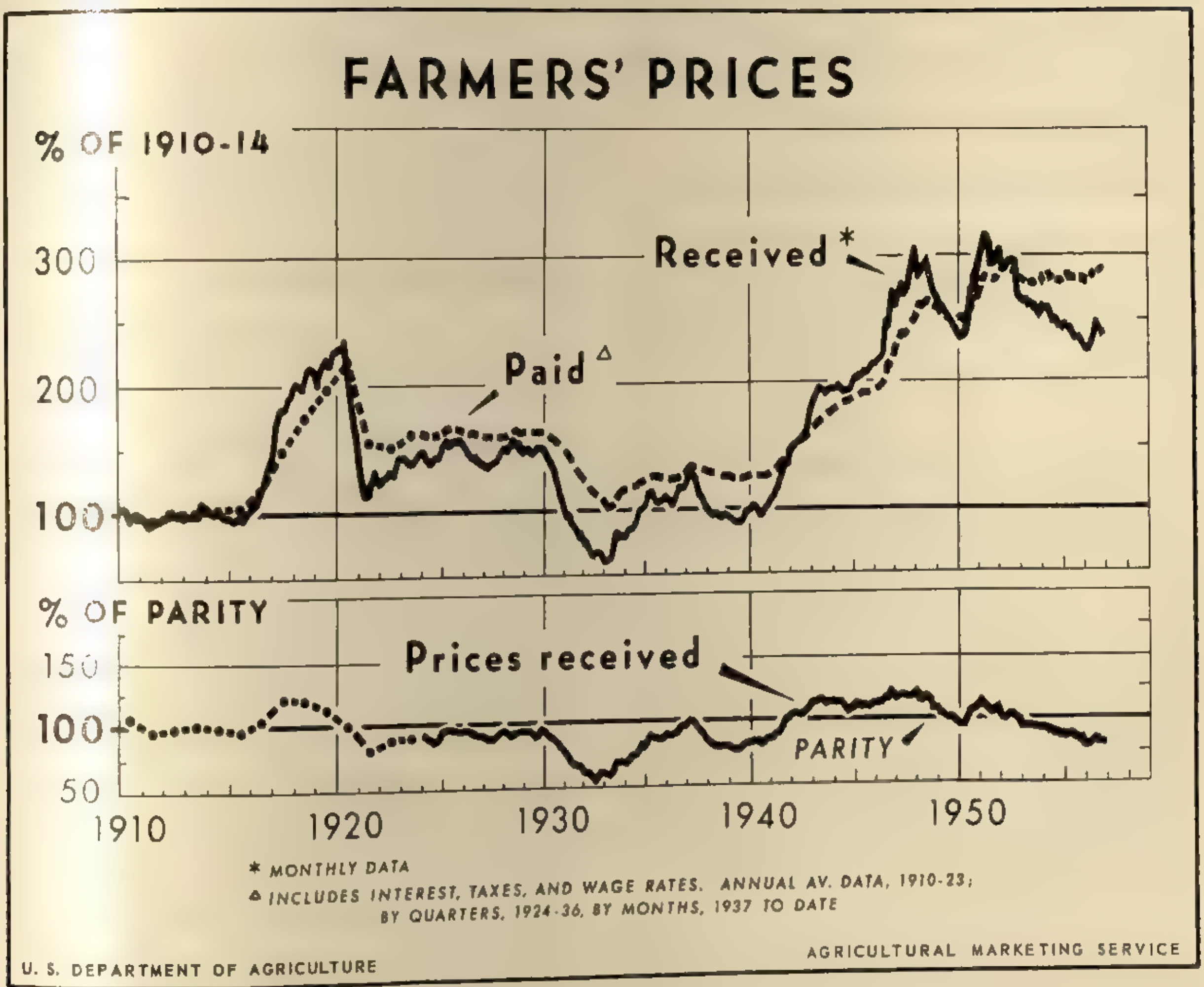
Successful farming requires family cooperation. The entire family plans the farm business and home consumption. Farm and family activities are closely interrelated.

CHART 66



The farm employment situation is adverse basically because too many people are employed in agriculture. Although the trend in the number of farm workers has been downward, the shift to other occupations has not yet proceeded far enough (in the country as a whole) to bring human resources into adequate balance with total job opportunities.

For some years to come, the number of openings in agriculture for new workers will be less each year than the number that will be required to replace those who leave because of age, death, or other reasons. Both the number of farm operators and the number of other farm workers are expected to continue to decline, though perhaps more slowly than in the recent past. By 1975, the total number of persons employed in agriculture may be a fourth less than in 1955.

Investment per Worker in Agriculture

Since before World War II, American agriculture has experienced a spectacular rise in the quantity of productive resources at the command of each farm worker. In 1956, the investment in land, service buildings, livestock, machinery, equipment, and other capital for operating a farm business averaged about $15,000 per farm worker. This figure is about half again as much as the average before 1940 in terms of constant dollars. By contrast, the average capital investment per factory worker today is only about two-thirds as much. The march of technology in one sense has reversed the former relative positions of farm and urban workers with respect to laborsaving and production-expanding aids. The increase in farm machinery and equipment since 1940 is especially startling. In sheer physical quantity, it is about

fourfold, and it includes many entirely new types of machines. This technological progress has increased the skills required for many farm jobs, and has also raised the amount of capital a man has to have to become a farm operator.

Significance of Agriculture in the Economy

Despite the less than rosy outlook for job opportunities in farming, agriculture will remain one of the larger areas of employment in the economy and will offer many opportunities. Moreover, a significantly expanding list of openings in fields closely related to agriculture will be available.

In 1950, 7 million or only about 1 in 8 employed persons worked on farms, but about as many more were employed at some other stage in the production of commodities of farm origin. Some of them were producing farm supplies such as fertilizer, processed feeds, and machinery. Others were engaged in transporting, storing, processing, packaging, or otherwise fabricating or handling farm products along the long route from the farmer to the final consumer. Estimates of the relative number of people employed at each stage, as computed from the 1950 Census of Population and other information, are shown in the tabulation in the next column:

Stage of production	*Percentage of total number of farm and related workers*
Total, all stages	100.0
Prefarm	9.7
Farm	47.5
Postfarm, food industries	27.2
Postfarm, textiles and others	15.6

Range in Scale of Farm Operations

Farms in the United States have been classified by the Census according to value of their annual sales (table 1). The data show that the business firms in agriculture—the farms—vary widely in the size of their operations. The trend toward fewer and larger farms from 1949 to 1954 (table 1) continues the trend during the last quarter century. Both commercial and other (noncommercial) farms decreased in this 5-year period. For farm operators, the consolidation of farms into larger enterprises has meant a need for more managerial skills. It has also meant a need for more capital and mechanical equipment.

Farming as a Way of Life

Farming, as a way of life, offers many attractions to the family. With modern means of transportation and communication, many of the

TABLE 1.—*Farms by economic class, United States, 1949 and 1954*

Economic classification	Value of annual sales	Number 1949	Number 1954	Percent 1949	Percent 1954
		Thousands	*Thousands*	*Percent*	*Percent*
All farms		5,379	4,782	100.0	100.0
Commercial farms	$250 and over [1]	3,706	3,326	68.9	69.6
Class I	$25,000 and over	103	134	1.9	2.8
Class II	$10,000–$24,999	381	449	7.1	9.4
Class III	$5,000–$9,999	721	707	13.4	14.8
Class IV	$2,500–$4,999	882	811	16.4	16.9
Class V	$1,200–$2,499	901	763	16.8	16.0
Class VI	$250–$1,199 [1]	717	462	13.3	9.7
Other farms		1,673	1,456	31.1	30.4
Part-time	$250–$1,199 [1]	639	575	11.9	12.0
Residential	Under $250	1,030	879	19.1	18.3
Abnormal [2]		4	3	.1	.1

[1] Farms with sales of $250 to $1,199 were classified as part-time if the operator worked off-farm as many as 100 days or other income of the operator family exceeded farm sales.

[2] Includes, for example, public and private institutional farms and experiment stations.

SOURCE: Bureau of the Census, U. S. Department of Commerce.

former differences between rural and urban living are vanishing. Many people try to combine the best of both worlds by living in the country. Sometimes they also work in the city and become part-time or residential farmers.

Commercial family farms offer advantages that are attractive to many families. The economy of the farm is close at hand, visible to every member of the family, and shared in by all. A family whose members live and work together is likely to be a very closely knit unit.

Many men and women like the greater independence and freedom associated with various phases of farm work and living and are willing to accept lower economic returns than they would consider suitable in an urban environment. Conversely, greater economic incentives are required for many persons to shift to the greater pressures and strains of urban life.

Training Opportunities Available for Farming

The best initial training for farming is to grow up in a farm family. However, more than half the farm boys must look toward opportunities outside of agriculture. If one does not have an early farm background, it is usually best to plan a training program that will include a period of (placement) experience under adequate supervision on a successful farm. Experience as a hired worker on the type of farm in which the individual is interested is another way to gain necessary experience. Most agricultural colleges either require or strongly urge their agricultural majors to gain such experience if they have not acquired it earlier.

Several types of vocational-agriculture training are available under the Smith-Hughes Act, which provided for vocational training in the high schools, and other measures. These include:

1. All-day programs supervised by teachers who are agricultural college graduates.
2. Young farmer programs consisting of short unit courses carried on during the day, with intensive training in some aspects of farming such as growing broilers, or breeding cattle.
3. Adult farmer programs in evening classes (or day classes in off-seasons) giving intensive training in special problems, such as control of pests, planning adjustments in land use and treatment, and so on.

The most significant general sources of information and guidance available to farmers are represented by the network of services provided by the land grant colleges and universities and the U. S. Department of Agriculture. These services include the facilities of the various State and Federal experiment stations, the Extension Services, and resident teaching. The local county agricultural agent is frequently the best point of contact for the young person seeking advice and assistance in farming. The Farmers Home Administration system of supervised credit represents one example of credit facilities combined with a form of extension teaching.

Organized groups such as the Future Farmers of America and the 4–H Clubs also furnish valuable training to young farm people.

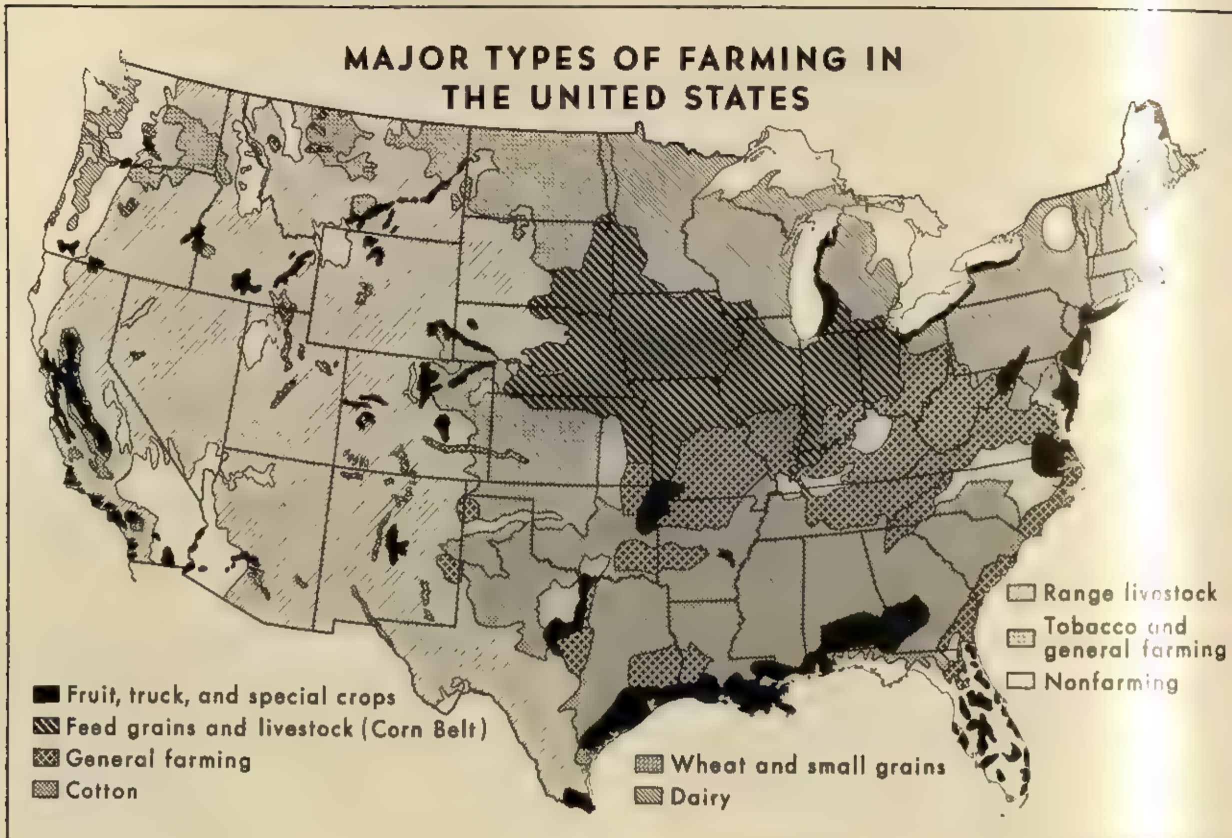
EMPLOYMENT OPPORTUNITIES ON FARMS

Despite the long-run decline in numbers of farms, farming is still one of the largest fields of employment. Nearly 5 million full-time and part-time farmers operate farms. In addition, a large number of hired laborers and several million unpaid members of the operators' families work on farms at some time during each year. The number of hired workers fluctuates seasonally from about 1 million in January to nearly 3 million at the peak of the harvest in September. Less than a half million hired workers have what may be considered year-round jobs, and nearly three-fourths of a million work for varying periods from 3 to 10 months during the year. The remainder, including many students and housewives, work chiefly during the peak harvest season. Also included in this group are nearly a half million hired farm workers who follow the crops each year. Most of these migratory workers travel northward as the season progresses and return to the South after the last harvest.

Employment opportunities for hired farm workers vary not only from season to season but also among geographic areas. Specific information concerning the kinds of jobs available and current wage rates can be obtained from the local offices of the State employment services.

In this chapter, information is provided on the major types of farms in the United States, and the nature of the work and managerial requirements for each type. Capital and labor requirements and the economic outlook in particular types of

CHART 67



farming are also discussed. The principal types of farming areas of the United States are shown in chart 67. Within each of the areas shown, a wide diversity of types of farms is found, but the type or types for which the areas are named tend to predominate.

For some of the selected types of commercial family-operated farms discussed, the U. S. Department of Agriculture has compiled statistics concerning capital investment, costs, and income (table 2), and total farm acreage, acreage harvested, and farm labor requirements (table 3).

TABLE 2.—*Capital invested, costs, and returns for selected types of commercial family-operated farms, averages for specified periods, 1937–55*

Item	1937–41	1947–49	1953–55	Item	1937–41	1947–49	1953–55
Dairy farms	Central Northeast			*Dairy farms*—Continued	Eastern Wisconsin		
Total farm capital	$9,440	$21,470	$26,967	Total farm capital	$12,420	$27,360	$33,717
Land and buildings	5,340	11,000	13,333	Land and buildings	8,700	16,750	19,787
Machinery and equipment	1,160	2,400	4,867	Machinery and equipment	1,320	3,420	6,507
Livestock	2,260	6,400	6,133	Livestock	1,840	5,140	5,077
Gross farm income	3,053	8,822	9,600	Gross farm income	2,799	7,981	7,760
Total farm expense	2,093	4,930	5,713	Total farm expense	1,319	3,616	4,487
Net farm income	960	3,892	3,887	Net farm income	1,480	4,365	3,273

TABLE 2.—*Capital invested, costs, and returns for selected types of commercial family-operated farms, averages for specified periods, 1937–55*—Continued

Item	1937–41	1947–49	1953–55
Dairy farms—Continued	Western Wisconsin		
Total farm capital	$8, 560	$18, 430	$22, 600
Land and buildings	5, 560	9, 620	11, 253
Machinery and equipment	800	2, 620	5, 013
Livestock	1, 710	4, 650	4, 600
Gross farm income	2, 169	6, 210	6, 299
Total farm expense	933	2, 926	3, 651
Net farm income	1, 236	3, 284	2, 648
Spring wheat farms (Northern Plains)	Wheat-small grain-livestock		
Total farm capital	11, 610	31, 090	42, 353
Land and buildings	8, 190	17, 050	25, 140
Machinery and equipment	1, 660	5, 430	9, 093
Livestock	1, 020	2, 610	2, 910
Gross farm income	2, 390	10, 801	9, 409
Total farm expense	1, 518	4, 478	5, 363
Net farm income	872	6, 323	4, 046
	Wheat-corn-livestock		
Total farm capital	11, 900	30, 600	41, 663
Land and buildings	8, 680	17, 130	23, 667
Machinery and equipment	1, 210	4, 500	8, 430
Livestock	1, 300	4, 390	5, 267
Gross farm income	2, 500	9, 544	7, 906
Total farm expense	1, 373	3, 572	4, 556
Net farm income	1, 127	5, 972	3, 350
	Wheat-roughage-livestock		
Total farm capital	8, 690	27, 630	39, 263
Land and buildings	6, 420	14, 710	22, 007
Machinery and equipment	1, 060	4, 030	7, 710
Livestock	800	3, 990	4, 643
Gross farm income	1, 777	8, 988	8, 828
Total farm expense	1, 244	3, 618	4, 905
Net farm income	533	5, 370	3, 923

Item	1937–41	1947–49	1953–55
Winter wheat farms	Southern Plains		
Total farm capital	$19, 460	$55, 970	$74, 470
Land and buildings	16, 400	42, 310	57, 793
Machinery and equipment	1, 820	5, 230	8, 273
Livestock	820	3, 810	3, 873
Gross farm income	2, 947	14, 186	10, 723
Total farm expense	1, 773	4, 170	4, 922
Net farm income	1, 174	10, 016	5, 801
	Wheat-pea (Washington and Idaho)		
Total farm capital	34, 090	103, 270	140, 407
Land and buildings	27, 490	84, 160	116, 067
Machinery and equipment	3, 640	8, 720	13, 430
Livestock	1, 040	1, 720	1, 887
Gross farm income	6, 110	18, 365	23, 107
Total farm expense	3, 346	6, 501	9, 230
Net farm income	2, 764	11, 864	13, 877
Corn Belt farms	Hog-dairy		
Total farm capital	15, 200	32, 440	42, 973
Land and buildings	10, 510	19, 340	25, 977
Machinery and equipment	1, 490	3, 410	5, 877
Livestock	2, 060	6, 090	5, 900
Gross farm income	3, 440	10, 191	11, 353
Total farm expense	1, 828	4, 552	5, 821
Net farm income	1, 612	5, 639	5, 532
	Hog-beef raising		
Total farm capital	10, 770	26, 050	35, 113
Land and buildings	7, 230	15, 780	22, 103
Machinery and equipment	1, 050	2, 390	4, 043
Livestock	1, 690	5, 210	5, 823
Gross farm income	1, 956	6, 183	6, 706
Total farm expense	1, 028	2, 813	3, 610
Net farm income	928	3, 370	3, 096

TABLE 2.—*Capital invested, costs, and returns for selected types of commercial family-operated farms, averages for specified periods, 1937–55*—Continued

Item	1937–41	1947–49	1953–55
Corn Belt farms—Continued	Hog-beef fattening		
Total farm capital	$20, 380	$46, 930	$59, 780
Land and buildings	14, 100	26, 950	36, 303
Machinery and equipment	1, 840	4, 100	7, 030
Livestock	2, 810	9, 940	9, 967
Gross farm income	5, 560	20, 198	18, 552
Total farm expense	3, 040	9, 533	11, 969
Net farm income	2, 520	10, 665	6, 583
	Cash grain		
Total farm capital	29, 950	63, 100	88, 030
Land and buildings	25, 040	48, 700	70, 147
Machinery and equipment	1, 860	4, 220	7, 337
Livestock	930	2, 780	2, 553
Gross farm income	4, 562	13, 575	14, 058
Total farm expense	1, 935	4, 645	6, 648
Net farm income	2, 627	8, 930	7, 410
Tobacco farms	Tobacco-livestock (Kentucky)		
Total farm capital	9, 440	19, 050	23, 720
Land and buildings	7, 900	15, 370	19, 080
Machinery and equipment	440	970	1, 910
Livestock	820	1, 930	1, 833
Gross farm income	2, 046	5, 468	5, 966
Total farm expense	854	2, 134	2, 717
Net farm income	1, 192	3, 334	3, 249
	Tobacco-cotton (North Carolina)		
Total farm capital	------	16, 130	20, 993
Land and buildings	------	12, 970	17, 233
Machinery and equipment	------	1, 370	2, 490
Livestock	------	1, 120	663
Gross farm income	------	7, 076	8, 026
Total farm expense	------	3, 868	4, 874
Net farm income	------	3, 208	3, 152
Tobacco farms—Continued	Tobacco farms (small) North Carolina		
Total farm capital	------	$8, 650	$10, 853
Land and buildings	------	6, 750	8, 917
Machinery and equipment	------	820	1, 127
Livestock	------	690	447
Gross farm income	------	3, 600	4, 231
Total farm expense	------	1, 2[illegible]	1, 665
Net farm income	------	2, 351	2, 566
	Tobacco-cotton farms (large) North Carolina		
Total farm capital	------	30, 370	38, 497
Land and buildings	------	23, 740	31, 280
Machinery and equipment	------	3, 670	4, 917
Livestock	------	1, 800	1, 233
Gross farm income	------	11, 49[illegible]	13, 021
Total farm expense	------	7, 56[illegible]	9, 219
Net farm income	------	3, 92[illegible]	3, 802
Cotton farms	Southern Piedmont		
Total farm capital	4, 700	11, 290	15, 390
Land and buildings	3, 610	8, 910	12, 553
Machinery and equipment	290	910	1, 560
Livestock	590	900	760
Gross farm income	1, 382	3, 581	4, 753
Total farm expense	887	2, 016	2, 888
Net farm income	495	1, 565	1, 865
	Black Prairie, Texas		
Total farm capital	8, 870	17, 210	26, 807
Land and buildings	7, 290	13, 540	22, 177
Machinery and equipment	680	1, 870	2, 877
Livestock	620	1, 210	1, 163
Gross farm income	1, 867	6, 104	6, 539
Total farm expense	848	3, 014	3, 685
Net farm income	1, 019	3, 090	2, 854

TABLE 2.—*Capital invested, costs, and returns for selected types of commercial family-operated farms, averages for specified periods, 1937-55*—Continued

Item	1937–41	1947–49	1953–55
Cotton farms—Continued			
	High Plains, Texas (nonirrigated)		
Total farm capital	$12, 100	$28, 870	$36, 837
Land and buildings	9, 570	24, 120	29, 057
Machinery and equipment	1, 470	3, 080	6, 733
Livestock	620	930	613
Gross farm income	3, 491	11, 886	6, 311
Total farm expense	1, 816	5, 475	4, 218
Net farm income	1, 675	6, 411	2, 093
	High Plains, Texas (irrigated)		
Total farm capital	-------	47, 290	84, 833
Land and buildings	-------	38, 640	70, 857
Machinery and equipment	-------	6, 460	12, 590
Livestock	-------	1, 130	670
Gross farm income	-------	20, 958	24, 049
Total farm expense	-------	10, 197	13, 967
Net farm income	-------	10, 761	10, 082
	Delta (small)		
Total farm capital	-------	6, 200	9, 770
Land and buildings	-------	4, 460	6, 883
Machinery and equipment	-------	890	2, 253
Livestock	-------	540	400
Gross farm income	-------	3, 270	3, 925
Total farm expense	-------	1, 347	2, 017
Net farm income	-------	1, 923	1, 908
	Delta (large-scale)		
Total farm capital	-------	110, 310	153, 467
Land and buildings	-------	84, 570	117, 400
Machinery and equipment	-------	13, 680	25, 640
Livestock	-------	7, 470	7, 033
Gross farm income	-------	66, 686	67, 168
Total farm expense	-------	46, 221	45, 180
Net farm income	-------	20, 465	21, 988
Sheep ranches	Northern Plains		
Total farm capital	$25, 380	$66, 740	$85, 087
Land and buildings	14, 980	38, 520	54, 000
Machinery and equipment	1, 410	4, 240	6, 943
Livestock	7, 920	19, 880	20, 920
Gross farm income	6, 523	15, 826	16, 819
Total farm expense	3, 789	8, 918	12, 228
Net farm income	2, 734	6, 908	4, 591
	Southwest		
Total farm capital	-------	120, 750	185, 390
Land and buildings	-------	94, 520	159, 580
Machinery and equipment	-------	1, 910	4, 723
Livestock	-------	22, 170	18, 337
Gross farm income	-------	16, 992	16, 334
Total farm expense	-------	11, 768	14, 657
Net farm income	-------	5, 224	1, 677
Cattle ranches	Northern Plains		
Total farm capital	20, 730	59, 640	71, 477
Land and buildings	11, 730	33, 320	42, 290
Machinery and equipment	1, 750	4, 570	7, 497
Livestock	5, 970	16, 970	16, 110
Gross farm income	3, 183	11, 166	9, 838
Total farm expense	2, 203	4, 700	6, 376
Net farm income	980	6, 466	3, 462
	Intermountain region		
Total farm capital	29, 050	67, 510	67, 363
Land and buildings	13, 930	26, 620	29, 123
Machinery and equipment	1, 460	2, 880	4, 323
Livestock	12, 780	34, 500	30, 073
Gross farm income	4, 344	11, 760	10, 485
Total farm expense	1, 452	3, 095	5, 711
Net farm income	2, 892	8, 665	4, 774
	Southwest		
Total farm capital	-------	97, 570	138, 153
Land and buildings	-------	71, 110	110, 103
Machinery and equipment	-------	1, 970	3, 817
Livestock	-------	22, 440	21, 447
Gross farm income	-------	13, 135	10, 037
Total farm expense	-------	7, 437	9, 052
Net farm income	-------	5, 698	985

SOURCE: Agricultural Research Service, U. S. Department of Agriculture.

TABLE 3.—*Average acreage and labor used on selected types of commercial family-operated farms, 1955* [1]

Type of farm	Farmland		Farm labor	
	Total	Cropland harvested	Total	Hired
	Acres	*Acres*	*Hours*	*Hours*
Dairy farms:				
Central Northeast	201	77	4, 450	710
Eastern Wisconsin	127	67	4, 360	520
Western Wisconsin	143	61	4, 040	490
Corn Belt farms:				
Hog-dairy	163	101	4, 490	580
Hog-beef raising	218	101	3, 760	260
Hog-beef fattening	199	138	4, 180	670
Cash grain	230	192	3, 390	470
Tobacco farms:				
Tobacco-livestock (Kentucky)	116	31	3, 780	[2] 1, 090
Tobacco-cotton (North Carolina)	100	40	6, 800	[2] 3, 880
Tobacco farms (small)	50	20	3, 740	510
Tobacco-cotton farms (large)	170	70	10, 190	[2] 7, 260
Cotton farms:				
Southern Piedmont	177	58	4, 560	[2] 1, 960
Black Prairie, Texas	171	103	4, 120	1, 640
High Plains, Texas (nonirrigated)	370	282	3, 330	1, 210
High Plains, Texas (irrigated)	314	277	8, 150	5, 730
Delta:				
Small	57	33	3, 390	600
Large-scale	1, 000	609	35, 910	[2] 32, 710
Spring wheat farms (Northern Plains):				
Wheat-small grain-livestock	690	443	3, 300	640
Wheat-corn-livestock	480	328	3, 980	480
Wheat-roughage-livestock	770	413	3, 530	230
Winter wheat farms:				
Southern Plains	714	364	2, 480	330
Wheat-pea (Washington and Idaho)	536	361	3, 320	1, 020
Sheep ranches:				
Northern Plains	6, 240	237	8, 060	3, 980
Southwest	12, 805	18	5, 330	2, 650
Cattle ranches:				
Northern Plains	4, 170	293	4, 490	1, 220
Intermountain region	1, 695	166	4, 860	840
Southwest	10, 610	21	3, 590	1, 010

[1] Preliminary.
[2] Includes sharecropper labor.

SOURCE: Agricultural Research Service, U. S. Department of Agriculture.

Corn Belt Farms

Description

Corn Belt agriculture includes two general types of farming: (1) Growing of grains and soybeans for sale, or (2) combinations of these crops with forage crops and livestock. Corn, oats, soybeans, hay, and wheat are the principal crops grown on Corn Belt farms. The chief livestock enterprises include hogs, dairy cows, and beef cattle. The typical Corn Belt farm has a small poultry enterprise. These crops and livestock enterprises are combined in various ways. The specific types of farms in each area differ primarily in the relative importance of these enterprises. Crop farms are located in the level parts of the Corn Belt, and the hog-beef raising farms are on the more rolling terrain.

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This is the last cultivation for this field of corn. Equipment used here greatly reduces the time required to produce a crop of corn.

The capital required to own and operate a Corn Belt farm depends on many things, including the size of the farm, the quality of the land, the amount of machinery needed for the particular kind of crop or livestock enterprise, and the size of the livestock enterprise. On the average, Corn Belt farms have from 160 to 230 acres. Total capital requirements for typical commercial family-operated farms usually range from about $30,000 to $100,000 per farm, but many farms have capital investments that are much greater. In addition to invested capital, a farmer also needs operating capital. The usual amount of operating capital required ranges from about $3,000 to $8,000 on farms whose operators do not buy feeder livestock. Where cattle feeding is an important enterprise, the amount of operating capital required may be double this amount. Capital requirements on the average crop farm also are more than twice as high as on the average hog-beef raising farm.

A high proportion of the land in the Corn Belt is rented. Consequently, it is not necessary to own all of the capital required for a commercial farm. Also, many farmers borrow part of the capital needed to acquire land, machinery, or other working assets.

Total labor required on Corn Belt farms usually varies from about 3,000 to 5,000 man-hours per year. On crop farms, this is largely seasonal labor, as most of the work is done in spring, summer, and fall. On livestock farms, particularly dairy farms, livestock must be cared for the year round. The total labor requirements on typical livestock farms are considerably above those on crop farms, and the labor is distributed more evenly over the year.

Net incomes on commercial family-operated crop farms averaged about $7,500 per year during the period 1953–55, compared with $3,100 on hog-beef raising farms (table 2). Net incomes on other types of Corn Belt farms usually were within this range. These estimates make no allowance for rent or interest paid. If the farmer rents all or part of the land he operates, or if he

pays interest on borrowed money, his net return is correspondingly reduced.

Nature of Work

Farming in the Corn Belt is highly mechanized and a variety of equipment is used. One requirement of a successful farmer is ability to service and use machinery properly so as to minimize wear and tear, avoid accidental damage to equipment, and safeguard the lives of those who work on the farm. A closely related attribute is mechanical skill, which enables him to obtain the maximum amount of high-quality work in a minimum of time.

A knowledge of soil management and maintenance and of crop varieties is useful in obtaining high crop yields. Timely preparation of seedbeds, and timely planting, fertilizing, and cultivating also contribute to high yields.

If livestock enterprises are included on the farm, as they usually are in the Corn Belt, additional skills are required. Success with livestock includes not only the ability to feed and care for the stock, and to recognize symptoms of common livestock diseases and parasites, and to treat them, but also to know when to buy livestock, the kind to buy, the price to pay for the grade of livestock to be purchased, and when to have stock ready for market.

Farming in the Corn Belt requires more hours of labor on the part of the operator than do some other types of farms, and more than most nonfarm jobs. Although long hours of work are required on most farms in some seasons, the work offers sufficient variety so that, for the most part, it does not seem wearisome.

The successful farmer should also be able to assume risks, make decisions, and accept the consequences. He must maintain a flexible method of operation; particularly he must be alert to changes in weather and markets so he can adjust his operations to take advantage of economic and physical changes and to minimize losses.

Outlook

A Corn Belt farm of average size and fertility, well-financed and well-managed, will provide a good living for a farm family. Total output of the average Corn Belt farm is larger than the average for farms in most other areas. High output permits greater efficiency in production. Favorable long-term prospects for farming in the Corn Belt are based on this relatively greater efficiency. A good living will be possible, even if the farm is relatively small or the farmer is heavily in debt, but it will require exceptional management and hard work.

Wheat Farms

Description

Wheat is probably grown on more farms and over a wider area than any other crop in the United States. It is a major enterprise on many farms in the Plains States and in certain areas in the Intermountain and Pacific Coast States. (See chart 67.) In these areas, shortage of precipitation, particularly summer rainfall, limits crop production. In years when precipitation is less than average, crop failures or near crop failures are likely to occur. Crop failures are not uncommon from time to time because of hail storms, wind blowing, or winter killing.

In the Northern Plains States, crops are planted in spring. Wheat, barley, rye, flax, and hay are the common crops. In the Central and Southern Plains, wheat is planted in the fall and is grown in rotation with sorghums for both grain and forage. On the nonirrigated lands of California, wheat, barley, and flax are grown in the winter, or rainy, season. In the wheat-producing areas in the Intermountain and Pacific Northwest areas, wheat is about the only cash crop grown. In the more humid sections of the Pacific Northwest, peas are rotated with wheat. In the less humid wheat-producing areas in the Pacific Northwest, Intermountain, and Plains States, wheat is rotated with summer fallow. In the transition area between the Corn Belt and the Plains, wheat is grown in combination with corn. Some acreage of nontillable land exists almost everywhere in the wheat-growing areas, particularly along the banks of rivers, the hillsides, and mountain slopes. This land is generally grazed by cattle or sheep. In most of these instances, sufficient hay or other forage is produced for winter feeding. Where corn is produced, hog enterprises usually are found.

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On most wheat farms, an operator with one of these self-propelled combines can cut about 30 acres of wheat in a 9- or 10-hour day.

Wheat farmers have been among the leaders in farm mechanization. The modern wheat farm is operated with heavy motorized equipment. More than half of these farms have two tractors, which range in size from about 20 to 40 horsepower. The average investment in farm machinery and equipment on a typical wheat farm in 1956 was about $10,000. Typical wheat farms average about 500 to 800 acres in size. The total capital invested in a typical wheat farm in the Northern Plains in 1953–55 averaged about $40,000 and in the Southern Plains about $75,000 (table 2). The farm operator, however, does not need 100 percent equity in the farm business. About two-thirds of the wheat farms are rented and part of the one-third of the farms owned by farm operators are mortgaged.

Total labor required on typical wheat farms varies from about 2,500 to 4,000 hours a year. Most of this labor is concentrated in two periods: (1) At seed bed preparation and planting time, and (2) at harvest time. Of course, if livestock enterprises are combined with wheat farming, there is a more uniform distribution of labor during the year. Wheat farming has been relatively profitable since the beginning of World War II except for occasional years when yields were low. From 1953 to 1955, net farm income averaged about $4,000 on spring wheat farms and about $6,000 on winter wheat farms. The net income averaged nearly $14,000 on wheat-pea farms.

Nature of Work

Because of conditions of high risk under which most wheat is grown, the operator should have sufficient capital to carry him over years of crop failure. He should be able to work at top speed for long hours during rush seasons. Effective use of labor on wheat farms depends on having tractors and farm machinery in working order. Ability to service and operate farm machinery is, therefore, essential for successful wheat farming.

Outlook

The average size of farms in most wheat areas has increased steadily during the last quarter century, but the number of such farms has declined. This decline has occurred because operators of larger farms have bought out operators of smaller operating units. This process is continuing. Farms of less than medium size tend to have higher costs per unit of product than do larger farms. Unless a prospective farmer is prepared to accept low returns for both his capital and his labor, he should not plan to operate a small wheat farm. Years of low income because of poor crops and unfavorable prices frequently come in succession. Average yields of wheat lands vary in some localities from only about 7 to 35 bushels per acre. A wheat farmer should be prepared to overcome the effects of the lean periods.

A prospective wheat farmer also needs to know about Federal Government programs and how they may affect him. Wheat is one of several major farm crops that receive price support under Federal Government programs. Other farm crops that are price-supported include cotton, rice, corn, tobacco, and peanuts. Acting under these programs, the Federal Government sets a certain price called a "support price," on each of the supported commodities. The Government makes this effective by offering to buy or to lend money on the crop at this price.

To get the support price, when supplies are large, the farmer must not plant more than a certain acreage of the crop. Each wheat farmer, for example, has an *acreage allotment*. He must not plant more than this acreage of wheat if he wants to receive price support. The Soil Bank Program is a further program for reducing acreage of wheat and other surplus crops even below the allotment level.

Cotton Farms

Description

Cotton growing requires hot weather and a long growing season. This restricts production of cotton to the southern half of the United States. Within this broad region, conditions under which cotton is grown vary from area to area, depending on weather, soils, labor supply, and many other factors.

The type of power used on cotton farms varies from 1 and 2 mules, which are still used on some farms in the Southeast, to large tractors with 4-row equipment which are used in the Mississippi Delta and the irrigated areas of the Southwest. In most areas, hand hoeing is needed to insure proper spacing of cotton as well as to control weeds not killed by mechanical cultivation. The time required for this work varies from 2 to more than 50 hours per acre during the growing season. Mechanical choppers, cross cultivation, flame cultivation, and chemical weed control have been used in a few areas to reduce the amount of hand labor for hoeing and chopping.

Mechanical pickers have been used extensively in areas with relatively level land and large fields such as the Mississippi Delta and irrigated areas in the Southwest. However, pickers are not used exclusively in any area. Full mechanization of cotton farming is difficult because of the need for more reliable methods of weed control and the large capital investment needed for equipment. Hand labor is sometimes used for picking cotton so as to maintain an adequate labor supply in the area for chopping and hoeing operations. The total labor required for cotton production varies from about 20 hours to 170 hours per acre, depending on the area, the degree of mechanization, and the yield of cotton.

The amount of commercial fertilizer used varies from none in the dryland farming areas of the Southwest to 500 pounds or more in parts of the Southeast. The amount and kind of insecticides used varies considerably. Sometimes as many as 15 applications are made in a year. In dust form or its equivalent, these applications of fertilizer may total nearly 200 pounds per acre. The development of strains of insects immune to the new types of insecticides also causes a problem in insect control.

One or more enterprises are usually carried on together with cotton growing. Additional enterprises provide fuller utilization of labor and equipment because these resources can be used when not needed for cotton. Restriction of cotton acreage through acreage allotments also releases

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Mechanical cotton pickers are used in areas where the fields are large and the land is relatively level. A machine can pick as much cotton as 20 men can pick by hand, but field waste, grade loss, and cost of the machine may offset much of the gain from savings in labor.

productive capacity for other enterprises. Corn, small grain, soybeans, grain sorghums, peanuts, tobacco, beef cattle, and dairying are among the important supplementary enterprises on cotton farms.

The requirements for land, labor (table 3), and capital (table 2) on some cotton farms, are averages for groups of farms. Thus, requirements for individual farms in the respective areas will differ from the averages, depending upon size and degree of mechanization. A large part of the labor used on the small Delta cotton farms and the Southern Piedmont cotton farms is supplied by family labor. On these farms, a part of the labor for chopping and picking may be hired. On the large farms in the Delta of Mississippi, family labor makes up a small proportion of the total. The labor requirements may be supplied by either cropper or hired labor. On Black Prairie and High Plains cotton farms, chopping and picking labor is hired but as these farms are rather highly mechanized, a large proportion of the other labor is family labor.

The amount of capital required varies from about $10,000 on small Delta cotton farms to about $150,000 on large Delta farms. The small Delta farms average 33 acres of cropland and use about 3,400 hours of labor annually. Large Delta farms have about 600 acres of cropland and use about 36,000 hours of labor each year. Capital required per acre of cropland harvested varies from about $130 on the nonirrigated farms in the High Plains to about $310 on irrigated cotton farms in the same area.

Net farm income ranges from an average of about $1,900 on the Southern Piedmont cotton farms to about $22,000 on the large-scale farms in the Mississippi Delta.

Nature of Work

In addition to the usual skills needed in crop farming, a cotton farmer should know the special requirements of the cotton plant which differ from those of other crops and also from area to area. The skills required vary also with size of operation and degree of mechanization. The larger farmers will need skill in the management of labor. The financial risk is unusually high in some areas because of hazards of weather. A farmer in such areas will need sufficient capital to carry him over years of low income.

Outlook

The acreage of cotton grown in the United States has declined by roughly 60 percent in the last quarter century. In some areas, such as eastern Oklahoma and northeastern Texas, cotton production has almost ceased. In many other areas, farmers are shifting to other types of farming, taking on other enterprises, or leaving the farm for jobs in industry. On the other hand, the acreage in cotton in the Lower Rio Grande Valley of Texas and in the irrigated areas in the Southwest is larger than it was in 1933 before controls were first placed on cotton acreage. In general, net farm income from cotton is lower than income from other types of farming in other sections of the country largely because cotton farms are usually small and are located in areas difficult to mechanize. However, incomes are relatively good on some cotton farms in many areas. A cotton farm that will yield a favorable income will have to be well managed and have sufficient size and capital.

Tobacco Farms

Description

Tobacco is produced chiefly in the eastern part of the United States. The main producing belt is in the east central part, but smaller districts are scattered over a large region. There are many types of tobacco and each requires a different soil and climate. The largest type is flue-cured tobacco; the second largest is burley. Although tobacco is produced under a variety of conditions, some common characteristics dominate. First, the labor requirements are high; second, the acreage grown by each operator is small, and third, a government acreage-allotment and price-support program is in effect for virtually all types of tobacco.

Tobacco farmers have been slow to mechanize. Although the use of tractors has increased greatly in recent years, one- and two-mule equipment is still used in many areas, either entirely or for certain operations such as cultivating.

The total labor required to produce an acre of tobacco varies from about 250 to 500 hours per acre, depending on the type of tobacco grown, the extent of mechanization, and other related methods of operation. Because some operations in tobacco require a rather large crew, some hired labor is commonly needed. Sharecroppers supply much of the labor on large farms. Certain practices aimed at reducing the quantity of hand labor have been introduced with marked results. The substitution of oil for wood in the curing of flue-cured tobacco and the use of the tobacco harvester, available since 1954, are examples. The larger and as yet unsolved problem is to mechanize completely the pulling of each leaf from the stalk.

Commercial fertilizer is an important item of expense on tobacco farms; applications of 1,000 to 1,500 pounds per acre are common. Control of diseases and insects in tobacco production is gradually becoming a decisive element of success. Supplemental irrigation is now used on tobacco with good results on some farms, but the practice is not widespread and consequently it is of minor importance in tobacco production as a whole.

Tobacco is commonly grown in conjunction with other cash crops or livestock enterprises. Tobacco-cotton, tobacco-livestock, and tobacco-general farming are examples of commonly occurring combinations of enterprises. However, some farmers who have large acreage allotments produce tobacco almost exclusively.

Land, labor, and capital used on tobacco-livestock farms in Kentucky and on tobacco-cotton farms in North Carolina are shown in tables 2 and 3.

Nature of Work

Considerable time is required to produce a crop of tobacco. From the time work begins on the

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These racks full of flue-cured tobacco are ready to be placed in the curing barns in the background. Harvesting tobacco is generally a hot, wearisome task requiring many hours of hand labor.

plant bed in early spring until the crop is sold, a period of 8 to 15 months may elapse. The duration depends largely on the type of tobacco grown. The raising of tobacco involves much hard work. The skill required in tobacco farming is more exacting than for many other crops, and it can only be acquired by careful training and observation. Any one desiring to become a tobacco farmer should first work on a tobacco farm for some time in order to become familiar with the practices and problems of tobacco production.

Outlook

The total acreage of tobacco grown in the United States has not changed greatly in the last quarter of a century, but the yield per acre and the number of growers have increased greatly. There also has been a shift from the dark and fire-cured types of tobacco to the lighter types, such as flue-cured and burley used in cigarettes.

A new factor to consider in the outlook for tobacco is homogenized or processed tobacco, the manufacture of which yields a greater number of units of finished products for a given quantity of leaf. Homogenized tobacco has already made its influence felt in cigar binder tobacco and is becoming important in cigarette-type tobacco. The use of filter-tip cigarettes also reduces the quantity of leaf required per unit of cigarettes made. These changes in methods of manufacturing are affecting the traditional pattern of prices for different grades of tobacco by boosting the demand for lower grades at the same time that the demand for higher grades is declining.

Given an adeqate tobacco acreage, a good income can be made by growing tobacco. However, most tobacco acreage allotments are very small, and it is becoming progressively more difficult to obtain a farm with an adequate tobacco Federal acreage allotment. For this reason, it is important to consider additional enterprises for which a tobacco farmer may be suited.

Sugarcane Farms

Description

Successful raising of sugarcane requires, among other things, a warm climate, a relatively fertile soil, considerable moisture, and a long growing season. It is grown principally in Louisiana in the flat alluvial soils of the lower Mississippi Delta and on peat soils in southern Florida.

Two types of operations are common in Louisiana. One is the large sugarcane farm which produces, on the average, about 1,000 acres of cane annually and represents an investment of about $270,000. The other is the family-scale sugarcane farm which averages about 40 acres of cane production and represents an investment of about $16,000. In Florida, sugarcane farming is almost exclusively large scale.

Incomes on sugarcane farms vary greatly. Because of the Federal program aimed at stabilizing farm production and prices, variation in yields is perhaps the main factor causing fluctuations in income. Changes in yields per acre also have a marked effect on costs of production. A substantial cash reserve is necessary for operation of a sugarcane farm.

The mechanical power used on large-scale sugarcane farms is exclusively tractor; the tractors and complementary equipment are large in size. On family-sized operations, both tractors and mules are used. In the early and mid-1950's, it took about 100 hours of labor to produce an acre of cane. With the expanded use of cane harvesters, the total hours of labor used to produce an acre of cane have been reduced by about 50 percent. Even so, cane farming requires a large force of hired labor. Hired labor represents about half the cost of sugarcane production.

Large-scale sugarcane operators tend to produce sugarcane almost exclusively but smaller operators also engage in minor enterprises in order to stabilize their income and to utilize family labor more effectively.

Nature of Work

In addition to a favorable physical environment, successful operation of a large-scale sugarcane farm requires knowledge of the best methods of growing cane, skill with farm machinery, and efficient management of labor.

The family-scale sugarcane farm operator must personally do much heavy work in addition to being a good manager.

Outlook

Production of sugarcane in the United States has doubled in the last quarter of a century. Per acre yields of cane have increased slightly but the greater acreage devoted to sugarcane is chiefly responsible for the increase in total production.

In view of the large-scale specialized nature of much sugarcane farming, the high capital investment required, and the small geographic area in which sugarcane can be grown, the opportunities to become an owner are limited. In family-scale farming the capital investment is much smaller, but the income expectancy is also smaller. Combining other enterprises with cane raising improves the level of income.

Production of sugarcane is subject to Federal regulation and it is influenced by production in our territories and other sugar-producing countries. Because these territories and other offshore countries have natural physical advantages in the production of sugarcane, expansion of cane production in continental United States is unlikely in the next few years.

Peanut Farms

Description

Peanuts are grown in the southern part of the United States. The three general areas of crop concentration are: (1) The Coastal Plains of Virginia and North Carolina, (2) the southern Coastal Plains of Georgia and Alabama, and (3) central Texas and Oklahoma. The most important of these areas is the Southeast where one-half to two-thirds of the Nation's annual peanut crop is grown.

Peanuts are grown for livestock feed as well as for human consumption. For human consumption, peanuts are used as nuts or peanut butter or are processed for extraction of edible oil. For livestock, they are used as a livestock feed concentrate with large acreages grown solely for "hogging off."

Peanuts are usually grown in combination with other crops or enterprises such as cotton, tobacco, grain crops, or forage crops. These are combined because of several factors, such as full utilization of family labor, Federal acreage allotments (which limit the acreage of peanuts a farmer may plant), and the necessity of rotating peanuts with other crops in order to keep disease at a minimum. Such farms generally have livestock. Mules are still an important source of power on many peanut farms.

Peanut farms in the Southeast usually range from 20 to 125 acres of cropland, with 20 to 25 percent of the acreage planted in peanuts. Two general varieties, the Spanish and Runners, are planted. The Spanish are often preferred for nuts while the Runners are used for both nuts and livestock feed (hogged off). Both types require a sandy loam, well-drained soil and both are fairly responsive to skillful fertilization.

The amount of capital required for a peanut farm varies with the size of the farm, the productivity of the soil, the extent of individual farm mechanization, the enterprises chosen to complement the peanut crop, and other related factors. Generally, an investment of $8,000 to $12,000 is required. Capital requirements range higher in the Southwest as more and larger machinery is used on the peanut farms in that area.

Labor requirements are high on peanut farms relative to other types of farms of similar size

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Shaking excessive soil from peanut vines before stacking for drying. Machinery which performs this work is available, but represents a significant outlay of capital.

in other parts of the country. Much hard and tedious hand work is necessary during the spring when the nuts are planted and during the early fall harvest season.

Gross farm income varies on peanut farms because of differences in crop yields, drought, disease, and price premiums for quality. Yields vary significantly among areas. Farmers in the Virginia–North Carolina area often produce twice as many pounds per acre as those in Georgia and Alabama. Nevertheless, gross farm incomes of from $2,000 to $6,000 are not uncommon in the latter area and net farm incomes range from $1,000 to $3,000 per farm.

Extensive hand labor is required in the growing of peanuts. The relatively small peanut acreage per farm, and insufficient machinery or labor to

harvest peanuts at the optimum time, have played an important part in the characteristically low net incomes per farm in past years. As more efficient crop production and harvesting practices are adopted, this situation can be expected to improve.

Nature of Work

A prospective peanut farmer must have a broad general knowledge of farming operations, as he probably will grow other crops in combination with peanuts. A considerable degree of skill is required for production of peanuts of high quality. An understanding of livestock production is helpful also.

As peanut farms become more mechanized, it will become increasingly necessary to have the mechanical skill required to operate and service this equipment. Mechanization will enable individual farmers to handle larger acreages. Managerial skills in directing the overall farm operation, skill in handling hired labor, and ability to do hard work in rush seasons are indispensable.

Outlook

As farms in the peanut areas become more mechanized and new production methods are developed, the crop production potential of the average peanut farm may be expected to increase. Peanuts are under Federal acreage allotments as are cotton and tobacco, which are often grown in combination with, or as alternatives to, peanuts. Limits are, therefore, placed on alternative uses of land, labor, and capital. There is no indication that the demand for peanuts as a food or edible oil will increase substantially in the immediate future.

Rice Farms

Description

To grow rice well requires a long warm summer, level land, and considerable water. Rice is grown in three major areas: Texas–Louisiana, Arkansas, and California. The Texas–Louisiana area is in southwestern Louisiana and southeastern Texas; the Arkansas area is chiefly in the east central part of the State; and the California area is in the Delta of the Sacramento River. Some rice is also grown in Mississippi and Missouri.

Rice farms are generally large and highly mechanized. With the use of modern harvesting machinery, total labor per acre is about 15 hours. Much of the labor is required to irrigate the crop. Purchases of field machinery, and outlays for a pumping plant and irrigation water represent major items of investment. Investment in machinery alone may run upward of $200 per acre. The cost of water and the operation of tractor and field equipment and pumping plant represent much of the cost of production. Although about 150 pounds of fertilizer are used per acre, fertilizer represents a minor item of expense.

Rice is often grown in combination with other enterprises such as cotton, soybeans, and beef cattle. The choice of supplementary enterprises depends on the physical situation in the particular area.

Net income from rice farming is generally satisfactory over a period of years. The variation in rice yields per acre is not great, and net farm incomes have generally been relatively stable.

Nature of Work

A successful rice farmer must be able to manage labor, machinery, soil, and water effectively. In view of the large investment in machinery for rice farming a good knowledge of machinery probably is more essential in this type of farming than in most other farm enterprises.

Outlook

Production of rice in the United States has doubled in the last quarter of a century. This increase has resulted mainly from an increase in acreage as the yield per acre has not changed significantly. The increase in acreage and production was made possible by successful mechanization of harvesting operations.

Rice production, which was overexpanded in the late 1940's, is now regulated through a Federal acreage allotment program. Because rice production levels and production facilities have been improved in the major rice-producing countries in the East and Middle East, it is not likely that expansion of rice production in the United States in the immediate future will equal that of the recent past. Rather, production may need to be stabilized for a number of years.

Sugar Beet Farms

Description

Growing of sugar beets requires a deep fertile soil and level land. In the Middle West, sugar beets are grown without irrigation, but in the West they require irrigation. The main producing areas are in the Red River Valley of Minnesota and North Dakota, in east-central Michigan, northwestern Ohio, and in the irrigated valleys of the Intermountain region and the Pacific States.

Tractor power is used almost exclusively in sugar beet farming and, together with its complementary equipment, has reduced labor requirements to about 60 hours per acre. Without mechanization, total labor might require up to 100 hours per acre. Those operations that can be mechanized involve the purchase of expensive machinery, the use of which requires rather large acreages to be economical. Many imported and other migratory workers are used in producing sugar beets. Employment of such labor must meet certain Federal and local standards with regard to wages, working conditions, and shelter.

The quantity of fertilizer used in growing sugar beets is moderate and fertilizer as well as other materials purchased do not entail large expense in comparison with the cost of labor.

Sugar beets are usually grown in rotation. However, they require considerable water and a deep fertile soil that is comparatively level. In many instances, the crop must be irrigated. Because of these requirements, considerable capital is invested in land, water, irrigation equipment, and machinery. Total investment may run upward of $500 per acre.

Production of sugar beets is regulated by a Federal program under which producers obtain a permit from the local sugar beet factory to grow a specified acreage of sugar beets.

Nature of Work

The sugar beet crop is a specialty crop and usually is one of several on the farm. As a result, the sugar beet farmer needs to have a well-rounded background and experience. Not only must he possess the skill required for a successful sugar beet enterprise but he must also have the requisite skills for the other enterprises on the farm.

The particular skill required in sugar beet growing is associated with a thorough knowledge of the soil and requirements of sugar beets, timing of operations, and management of labor and machinery.

Outlook

The total acreage of sugar beets in the Middle West has not changed greatly during the last quarter century; the yield per acre has increased somewhat. Much of the increase in yield on a national basis is attributable to new areas under irrigation in the West.

Production of sugar beets in the United States is influenced by the political arrangements with our sugar-producing territories and agreements with other sugar-producing countries. In view of these relationships, sugar beet growing in the United States cannot be considered an enterprise that faces the future with prospects of great expansion.

Reasonably good income can be made in growing sugar beets. Also, areas in which sugar beets are now grown are readily adapted to supplementary enterprises.

Western Crop-Specialty Farms

Description

In the valleys of the Rocky Mountain and Pacific Coast States are found many farms that produce crop specialties, such as potatoes, dry beans and peas, vegetable crops, vegetable seeds, grass or hay seeds, or hops. Usually, these crops are combined with other field or horticultural crops, or are grown as cash crops on general livestock farms. These specialty crops tend to be produced in relatively small localized areas where the local climate, soils, and marketing conditions are favorable to the crop. In the Western States, most of these crops are produced under irrigation because natural precipitation during the growing season is inadequate.

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Small plastic siphons are used here to assure an even distribution of water from the distribution ditch to the individual rows.

The production of some specialty crops tends to be closely integrated with their marketing. For example, hops are frequently grown under contract with the marketing agent.

In some instances, farmers have organized cooperatives to market their specialties. The producer makes his marketing arrangements in advance of planting in an attempt to obtain a satisfactory price for his product. Despite these arrangements, the prices received for many specialty crops fluctuate greatly.

Specialty crops generally require much labor and capital. Production of hops requires considerable labor and large investments in yards and kiln. Although these investments are of a semipermanent nature, they have little value other than in the production of hops.

Some specialty crops can be grown successfully on soils that are not well adapted to other crops. For example, some grass seed is produced on soils having a hard pan or impervious layer of subsoil. Some crop specialties are used to round out or balance the farm organizations on general farms. For example, sugar beets provide a cultivated crop on general irrigated dairy farms in many small valleys in the Intermountain region. A cultivated crop is essential in the crop rotation. In addition, beet tops are an additional source of feed for dairy cows.

Farms on which specialty crops are produced range in size from very small part-time farms to large commercial corporation farms. Because of the large variety of crops in the specialty category and the various conditions under which many are grown, it is usually possible for any producing farmer to select some specialty crop that will utilize to advantage a part or all of his available resources.

Nature of Work

An operator should be careful to select the enterprises that he can produce to best advantage

from the standpoint of climate, soils, irrigation facilities, available capital, markets, and size and type of business. A thorough knowledge of the production, marketing, labor, and capital requirements of the specialties selected and ability to apply this information on a particular farm is essential.

Outlook

Over a period of years crop-specialty farms offer good opportunities for profitable operation. Prices for many of these crops are highly variable and production expenses are high. Therefore, an operator should be prepared to accept a fluctuating income ranging from years of rather high return to years when losses may occur.

Fruit and Nut Farms

Description

Fruit and nut farms comprise less than 2 percent of all farms in the United States and occupy less than 1 percent of the land area in farms. Small acreages of fruits and nuts are found on many farms of all types but are unimportant as a source of income except on relatively few specialty farms.

The specialty fruit and nut farms are generally concentrated in areas around the Great Lakes, along the Pacific Coast from Washington to southern California, along the Gulf Coast from Texas to Florida; and in several small areas in the interior regions of the Rocky Mountains, the Ozark Highlands, and the Cumberland Valley area.

Citrus fruits are confined to southern regions and are commonly found in Florida, Texas, and southern California. Apples, peaches, and strawberries are grown in all areas; apple production is concentrated more in the north and peaches slightly farther to the south.

Pears, cherries, plums, and grapes are concentrated on the West Coast and around the Great Lakes. Walnut acreages are most often found on the West Coast while pecans are generally grown in the Southeast. Production of berries, such as cranberries, blueberries, blackberries, and elderberries, has added to incomes on many farms and has given rise to specialty farms, many of which occupy land formerly referred to as wasteland.

Production practices for bush berries vary from the mere collecting of wild berries to the intensive cultivation of cranberry bogs. Strawberry production differs from that of most other types of fruits and nuts. Investment is small, production practices are relatively simple, and shifting in and out of production is frequent.

Fruit and nut farms for the United States as a whole average about 95 acres per farm but half of these farms average less than 20 acres of cropland. About three-fourths of the cropland on fruit and nut farms is utilized by these crops.

In 1950, 66 percent of the fruit and nut farms yielded net incomes between $1,200 and $10,000 and about 50 percent had incomes between $1,200 and $5,000. Incomes are seasonal and fluctuate violently from year to year. Sales on all fruit and nut farms averaged about $9,000. Investment in land and buildings averaged about $33,000 per farm, or $360 per acre. Tenancy is not common on fruit and nut farms. In 1950, more than 80 percent of the operators were full owners and an additional 10 percent were part owners. The establishment of a new orchard requires outside sources of income until trees begin to bear.

Nature of Work

Operators of fruit and nut farms must have exceptional skills. Careful planning in the selection of varieties for future production is essential. Use of proper methods and procedures for replanting, as well as ability to foresee the proper time for making changes in the size of the farm operation, are also important. Disease and insects must be constantly fought. The question of how far one should go in trying to minimize losses by additional insect control becomes complex. Management of money is exceptionally important because of irregular returns. Ability to manage semiskilled labor is essential to maximize returns from the harvesting and marketing processes. This is especially true for fruit production because of the perishable nature of the product.

Chores throughout the year that require some mechanical aptitude include the application of spray materials, and pruning, cultivating, fertilizing, and irrigating when needed.

Operators of fruit and nut farms do not have to perform daily routine chores as on dairy, livestock, and poultry farms. Thus, fruit growers are not tied down during off-seasons of the year but throughout the harvest season they must be willing to work long hours and frequently on Sundays.

Outlook

Fruit farming should be considered as a good long-term investment only if the individual is willing to accept considerable variability in income. He must be able to provide good management and be willing to act when there is considerable risk. For this, he may expect a fair return from a relatively high investment per acre. Recent increases in per capita fruit consumption, in addition to newly developed marketing processes for frozen foods, reduce the risk and improve the future outlook for efficiently operated, well-financed fruit and nut farms.

However, the individual must be cautious about going too heavily in debt to start new orchards or to increase the size of business because it is difficult to foresee periods when general overexpansion may take place.

COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

Modern sprayers such as this put out about 35 gallons of spray per minute. Timely application of insecticides is essential for successful orcharding.

Vegetable Farms

Description

Vegetable farming is carried on to some extent in every State. However, this type of farming is relatively unimportant in most of the interior States, except in a few localized areas near large cities and in a few irrigated areas in the Southwest and the Mountain States.

Most vegetables are highly perishable and thus require an immediate market at harvest time. For this reason, market gardeners who grow vegetables for fresh consumption are often located near large urban centers, although in the winter and early spring fresh vegetables are shipped to northern markets from vegetable farming areas of Florida, southern Texas, Arizona, and California. The absence of local competition for various resources, including transportation, at these seasons of the year makes such long distance high speed shipment profitable.

Vegetables grown for canning and freezing depend on availability of processing plants. Processing plants are usually located in areas where the soil and climatic conditions for one or more vegetables are favorable, and they may be located in areas where there is no readily available fresh market. For example, considerable acreages of beans and tomatoes are raised on a contract basis for canneries in the Ozark Plateau region. This area, which has no large fresh market nearby, has soils and climate suitable for production of these two vegetables.

Many vegetables are more exacting in their climatic and soil requirements than are most field crops. Green peas, lettuce, and celery, for example, require a rather cool climate where daytime temperatures do not exceed the 70's for any prolonged period. On the other hand, tomatoes, lima beans, snapbeans, peppers, and eggplant require much higher temperatures but may be damaged severely either by prolonged dry periods with extremely high daytime temperatures or by periods of abnormally cool wet weather.

The best type of soil for most vegetables is a well-drained, light, sandy loam. Some vegetables are particularly susceptible to plant diseases, such as blight and root rot. Attempts to grow these vegetables on heavy, poorly drained soils are likely to result in failure.

About 1 percent of the farms in the United States in 1949 reported vegetables as their major source of income. These farms, however, accounted for more than two-thirds of the value of all vegetables sold by farmers in that year. Approximately 70 percent of these farms were concentrated in States along the Atlantic and Pacific Coasts and around the Great Lakes.

Vegetable farms vary greatly, ranging from highly specialized large farms raising 1 or 2 vegetables to small farms raising a variety of vegetables for the fresh market in nearby cities.

Nature of Work

Vegetable farming generally requires large amounts of labor and capital. The operator must work long hours during the harvest season as many vegetables must be harvested within a very short period to prevent loss. He must (1) plan his layout carefully in order to avoid extreme labor loads at harvest time, (2) recognize early the numerous insects and diseases that prey on vegetables and know how to combat them, and (3) adopt the production and marketing practices that are best suited to his particular locality. A person who plans to go into vegetable farming should get in touch with his local county agricultural extension agent who can provide valuable information as to the vegetables that do best in the area selected and that usually find a ready market at harvest time.

Outlook

Vegetable farming is generally a high-risk operation and, if conditions are favorable, returns for labor and capital may be better than for lower risk enterprises. However, many things may go wrong. Frost, disease, insects, or drought may seriously damage or wipe out a crop. Overplanting frequently causes serious market gluts. Weather may cause a crop to be delayed, thus overlapping the harvest season in two areas with a resulting depressed market. However, over a long period of time the good and bad years tend to balance, making vegetable farming under favorable conditions a reasonably profitable venture.

Although the demand for vegetables will probably increase during the next few years, increased

acreages of vegetables will not be required because improved technology will result in increased output per acre. The trend toward increased use of frozen foods probably will favorably affect markets for fresh vegetables, especially for those that freeze well. At the present time, production of green peas for the fresh market has practically disappeared as a commercial enterprise. Likewise, most of the green lima beans are going into the canned or frozen product. This upward trend in production of vegetables for the canned and frozen trade will tend to smooth out some of the seasonal price variations and will encourage the continued development of larger and more specialized vegetable farms. The number of smaller and more diversified market-garden-type farms will tend to decline.

Dairy Farms

Description

Dairy farming is one of the major types of farming in the United States and is a common type in many areas. Heaviest concentrations of dairy farms are in the Northeast, the Lake States, the Pacific Northwest, and in many smaller areas surrounding centers of population (chart 67). Climate and rainfall are particularly favorable to the production of high-quality hay and pasture, which are needed in dairy farming, in the Northeast, the Lake States, and the Pacific Northwest.

The type of market outlet and the relative level of prices received by dairy producers are closely related to distances from population centers. Producers close to urban areas have the greatest advantage so far as production of milk for fluid use is concerned. The lower prices received by more distant producers reflect the more highly perishable nature and higher transportation costs of fluid milk when compared with most manufactured dairy products.

Most northeastern dairy farmers produce their own roughage (hay, silage, and pasture) but very few produce all of their concentrate feed. The proportion of concentrates purchased varies widely among areas and among farms within an area, but northeastern dairymen generally have found that it pays to keep enough cows to utilize fully the labor supply and roughage-producing capacity of their farms, even if it means buying all their concentrates. Production of milk in the Northeast is primarily for a fluid milk market.

In some parts of the Lake States, the sale of milk for fluid use and specialization in milk production is typical of areas adjacent to relatively small urban markets. Milk in excess of fluid needs goes into evaporated, condensed, and dried milk, and into butter, cheese, and other manufactured products. Dairying has been expanding westward and southward, but most of the expansion is for manufacturing purposes and is taking place on farms where dairying is usually not the major enterprise.

COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

Most of the milking on commercial dairy farms is now done by machine. One man can operate 2 units like this one and can milk 3 or 4 times as many cows per hour as a good milker can milk by hand.

Dairy farms in the Pacific States also are of two distinct kinds, depending on the type of market outlet. Near urban centers, farms are more expensive and have a larger number of cows but are not necessarily larger in acreage. Whole milk is sold to city dealers or is retailed at relatively high

COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

The service buildings on commercial dairy farms represent a substantial investment. Sometimes conditions change and make them obsolete before they wear out.

prices but under strict sanitary regulations. The other dairy farms are subject to less strict sanitary regulations; they sell milk or cream on a butterfat basis to manufacturing plants. Production of fluid milk near Los Angeles has become highly specialized and commercialized. Large herds are handled chiefly by hired workers under factorylike conditions.

Dairy enterprises are frequently found on diversified farms. Combinations with poultry, cash crops, and other livestock enterprises are numerous and help to utilize labor and other resources that might be wasted otherwise. In general, however, the trend is toward greater specialization in agriculture rather than toward greater diversification.

Dairy farms have become highly mechanized in recent years. Increased availability of electricity and running water contribute to this high degree of mechanization. Expensive electric milking machines and milk coolers have become virtual necessities; many other machines required for efficient harvesting of hay and other field crops necessitate large investments. Investment in machinery and equipment on commercial family-operated dairy farms in 1953–55 averaged about $4,900 in the Central Northeast and about $6,500 in eastern Wisconsin. (See table 2.)

The size and organization of dairy farms vary considerably among and within areas. In the Central Northeast, where dairy farms are most numerous, the average size is about 200 acres with about 75 acres of cropland harvested. (See table 3.) Net incomes on these farms averaged about $3,900 in 1953–55. Labor required to operate them averaged about 4,500 hours. Most of the work is performed by the operator and his family and, except for haying and harvesting, it is distributed quite evenly throughout the year. During haying and harvesting, additional labor is frequently hired or traded with neighboring farmers.

Nature of Work

Dairy farms provide full-time employment and relatively small fluctuations in income for the operator and his family. However, farm chores, especially feeding and milking, must be done every

day at fairly definite times. The hours at which chores are performed contribute to long daily hours of work Because of this, the dairy farm operator and his family are tied down more than are operators of some other types of farms.

Operators of dairy farms must have many skills. Mechanical aptitude is required to operate and service farm machinery and equipment. Ability to maintain buildings is important, and an understanding of livestock and plant disease control is essential.

As important decisions must be made constantly, the operator of a dairy farm must endeavor to improve his knowledge continually. In addition to deciding when, what, and how much to plant, dairymen must decide whether or not to adopt various new innovations such as pen barns, milking parlors, pipeline milkers, automatic gutter cleaners, silo unloaders, and trench silos. If such innovations are adopted, further decisions must be made regarding changes in size of operations and combination of enterprises. Operators should also know how to adjust to changes in the cost rates and prices they must pay for the goods and services used in production in order to increase profits.

Outlook

As dairy farming is becoming more specialized, operators of small dairy farms find it increasingly difficult to produce profitably. Increasing burdens have been placed on dairy farmers. Capital investments are higher, more industrial goods and services are needed for economical production, and increased mechanical and management ability are required. Returns per hour of operator and family labor are low compared with hourly earnings of industrial employees. However, dairy farmers probably will continue to have more stable incomes compared with operators of most other types of farms.

The short-run outlook for dairying is not encouraging, except in areas that are favorably located with respect to certain milk markets. Continued increases in population and per capita consumption of milk and other dairy products point toward an expanding dairy industry in the long run. The total number of dairy farms probably will continue to decrease, but in terms of acres of land and numbers of cows, the size of dairy farm operations will continue to increase. Production of milk may exceed normal market outlets for several more years.

Poultry Farms

Description

Poultry production is usually carried on as a sideline of the regular farm business in most parts of the country, or on a part-time basis along with a regular nonfarm job. There are many specialized full-time poultry farms, however, especially in the northeastern States. Some of these farmers specialize in egg production and others in broiler production; some raise turkeys or other kinds of poultry. Whatever the product, however, the larger operators usually buy most or all of their feed and grow little or no field crops. Thus, most of the work is indoors.

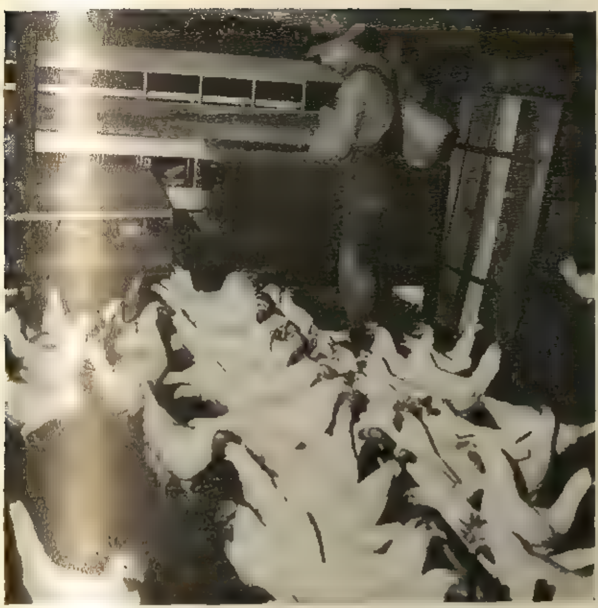
With a commercial laying flock, a large part of the labor is used in gathering eggs and preparing them for market. Most of the rest of the time is taken up in feeding, watering, and caring for the flock. Raising the replacement flock requires much time and attention, usually in the spring. There are large numbers of specialized commercial egg farms in New Jersey; they are also common in some other northeastern States.

Broiler producers usually market three or four lots of birds a year, depending on the weight to which the birds are fed. One of the most concentrated broiler-producing areas is the so-called Del-Mar-Va area of Delaware and eastern Maryland and Virginia. Other States, such as Georgia and Arkansas, have recently shown sizable increases in production of broilers.

Nature of Work

Most of the work on a typical poultry farm is done by the operator with some help from his family. Outside help is usually hired only for peak-load jobs like cleaning and disinfecting poultry houses.

Poultry farms usually are relatively small in terms of acreage but they involve substantial capital investments. It is quite common to have $10 to $15 per layer tied up in land, buildings and



COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

Poultry farms are getting larger and more specialized, requiring greater use of mechanical equipment. Here, a Pennsylvania poultryman dumps feed into the hopper of his automatic feeder

equipment, birds, feed, and supplies. Many operators find that they also need additional financial reserves or a good source of credit to tide them over the bad years that frequently occur.

Outlook

The production of poultry and eggs is a highly competitive business and will probably continue to be so. The average operator has steadily increased the efficiency with which he converts feed into meat and eggs, and further gains are in prospect. The competitive pressure is forcing many producers to enlarge the size of their operations in order to maintain adequate incomes.

During recent years production of poultry has expanded considerably and fluctuations in prices and earnings have occurred fairly regularly. These fluctuations result from the tendency on the part of many producers to plan next season's operations on the basis of the current season's prices. The "in-and-outer" finds it difficult to operate profitably in the poultry business. Those who make a good living in the poultry business develop a business of adequate size, produce efficiently and tend to stay in the business through good and bad years.

Livestock Ranches

Description

Livestock ranches are very important economically in all of the 17 western States, particularly in certain sections of these States, and they are growing in importance in many other States. From 20 to 50 percent of all farms in 11 of these States are livestock farms or ranches. Except for miscellaneous and unclassified farms, livestock ranches are numerically the most common type in most of these States.

Livestock ranching is ordinarily found in areas where the annual precipitation is less than 15 or 20 inches, where the land is unproductive for crops, where most of the precipitation comes in the winter, or where the terrain is too rough for the use of mechanical equipment. The grazing capacity of the native rangeland in the western ranching area generally varies from around 12 to 100 acres of rangeland per animal unit. An animal unit in the range area is usually considered to be one head of mature cattle or five ewes.

The common characteristic of livestock ranches is that the livestock derive a large part of their feed from native forage and uncultivated land, and most of the income of ranchers comes from the sale of cattle or calves, or sheep and wool. However, the characteristics of livestock ranches in each of the general areas differ widely in important aspects. A comparison of some of the major characteristics of livestock ranches in three important areas—the Northern Plains, Intermountain, and the Southwest—provide a general impression of the organization and labor and capital requirements of livestock ranches and of some of the major differences in ranches that result chiefly from differences in physical and economic factors.

Cattle and sheep in the Northern Plains livestock area are maintained largely under fence, and winter feeding is necessary. The operator usually produces some grain (mostly wheat) and hay in addition to sheep or cattle. About 5 percent of the total cash receipts is from the sale of grain. The hay is fed on the ranch. The grazing land is fairly productive and the average acreage of grazing land per animal unit is around 25 or 30 acres.

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In many western areas, sheep get most of their feed from the range. Some herds migrate from spring-fall to summer and winter range. A herder watches the gains on his sheep and knows when, where, and how fast to move his sheep. A herder and his dogs usually graze from 1,000 to 1,250 head of sheep.

Approximately 1,200 stock sheep are kept on the sheep ranches in this area. In 1953–55, the average value of sheep on these ranches was about $21,000, and the total value of the ranch, including sheep, was about $85,000.

The breeding stock on the usual cattle ranch in the Northern Plains consists of about 90 head of breeding cows and heifers. In 1953–55, the total capital invested in the ranch averaged about $71,000. A little more than $16,000 of this was in livestock.

The average cattle and sheep rancher in the Intermountain region has more cattle and sheep than the operator in the Northern Plains. Operators in the Intermountain region, however, have less land as their stock graze considerably on public domain. The total ranch investment in the Intermountain region was about the same as for ranches in the Northern Plains, but the investment in livestock on Intermountain ranches was almost double that on Northern Plains ranches. Sheep ranchers in the Intermountain region maintain around 1,400 or 1,500 head of stock sheep. Because these sheep are maintained largely on public grazing land, considerable expense is involved in hiring herders and in moving sheep from winter range to spring-fall and summer ranges.

Livestock on ranches in the Southwest are kept almost entirely under fence. As the winters are mild and open, livestock graze practically the year round. Except in drought years, little or no supplementary feeding is required. It takes about 60 acres of grazing land to carry an animal unit of cattle or sheep in the Southern Plains. In this area the average cattle ranch consists of about 10,500 acres and sheep ranches nearly 13,000 acres. In 1953–55, the total ranch investment on sheep ranches in the Southwest averaged $185,000, and on cattle ranches $138,000. The livestock investment on cattle ranches averaged $21,000 compared with about $18,000 on sheep ranches.

Returns to livestock ranchers in the Far West are highly variable; they range from a loss in some years to a net gain of upward of $20,000 per ranch

in other years. In areas farther east, where grazing and general production conditions are less variable, returns are more stable.

Practically all of the sheep ranchers' income is from the sale of feeder lambs and wool. None of the lambs are grain-fed and sold as fat lambs on these ranches. In years when grazing conditions are exceptionally good, some of the lambs may go to market as grass-fattened lambs, but this practice is infrequent.

Cattle ranchers generally have more cropland than sheep ranchers and derive some income, though usually relatively little, from the sale of grain crops. Most ranchers sell calves, above herd replacements, in the fall. These go mainly to the Midwest for further feeding and fattening. Some ranchers hold their calves over, selling them as long yearlings, 2-year-olds, or even 3-year-olds. Few ranchers in the Far West have sufficient productive grazing land to sell grass-fattened cattle.

Nature of Work

Stock ranching is relatively specialized and requires good management combined with a thorough knowledge of livestock breeding and raising under range conditions. The work is seasonal in nature and, in many instances, it demands personnel that are willing to undergo hardships and at times to live under difficult and trying conditions. At roundup time in the fall and at lambing, docking, branding, and dehorning time in the spring, long hours of hard work are the rule. In the spring and sometimes in the fall, one must be willing to subject himself to the fury of nature. Working in cold driving wet winds is not uncommon. There are compensations, however. There is considerable freedom in the wide-open spaces and the enjoyment of living close to nature.

Outlook

Greater production of meat will be necessary to meet the demands of our steadily increasing population. Consumption habits are trending toward fewer potatoes, cereals, and grains to more milk, meat, eggs, poultry, fruit, and vegetables. The outlook for wool is favorable and assistance is offered to operators under current and prospective Federal programs for wool. Sufficient financing, thorough training, and a basic knowledge of the ranching industry are essential for survival in the ranching business and even more important for prosperous operations.

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Rounding up cattle in the fall requires considerable know-how of both rider and horse.

SPECIALIZED AGRICULTURAL OCCUPATIONS

As agriculture becomes more technical and commercial, the number of people directly engaged in farming decreases but the number who engage in services related to agriculture multiplies rapidly. Power machinery, for example, saves many man-hours of labor on the farm but calls for a staff of workers to design, produce, and distribute the machines used by the farmers.

A large number of the vocations that are growing up around agriculture are of a professional or technical nature and call for college training or its equivalent.

Other vocations are in the nature of special services to farmers which can sometimes be learned through on-the-job training. For many of these positions a farm background is not essential, although it may be helpful. The Association of Land-Grant Colleges and Universities reported in 1955 that 15,000 college graduates could have been employed in agriculture and related fields but that the land-grant colleges graduated only 8,500. The number of openings in the various fields were reported as follows:

Agricultural research	1,000
Agricultural industry	3,000
Agricultural business	3,000
Agricultural education	3,000
Agricultural communications	500
Agricultural conservation	1,000
Agricultural services	1,500
Farming and ranching	2,000

Agricultural Extension Service Worker

Nature of Work

Cooperative Extension Service workers are joint employees of their State land-grant college and the United States Department of Agriculture who engage in educational work in agriculture and home economics. Because their work is primarily educational, extension workers must be proficient in both subject matter and teaching methods.

County extension agents are concerned primarily with increasing the efficiency of agricultural production and marketing, including the development of new market outlets. County home demonstration agents work closely with women in such fields as home management and nutrition.

Agricultural extension workers try to help people to analyze and solve their problems. In doing this, extension workers help local people apply the results of research and practical experience to their problems. Much of this educational work is with individuals and groups through meetings, tours, and demonstrations. Individual assistance is given to farmers and homemakers on problems that cannot be solved satisfactorily by group methods. Both the county agent and the home agent, along with the 4–H Club agent in counties that have one, work with rural youth in organized groups on projects related to agriculture, homemaking, and community improvement. Extension workers rely heavily on the use of mass communications media, such as newspapers, radio, and television.

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A county agricultural extension agent discusses livestock production problems with a farmer in the feedlot.

The work of the county extension staff is backed up by State extension specialists in such subject matter fields as agronomy, livestock, marketing, agricultural economics, home economics, horticulture, and entomology. These specialists keep in close contact with the latest research findings in their particular field and work with agents in applying these to local needs and problems.

Where Employed

Extension agents are located in nearly every agricultural county in the United States. In counties with a large number of farmers who produce a variety of crops there may be as many as 10 or more agents on the county staff. In these counties, the agents usually specialize in particular fields, such as dairying, poultry production, crop production, or livestock.

Training and Other Qualifications

The first qualification for a county agent is a bachelor's degree in agriculture or home economics. In most States, the Extension Service maintains an in-service training program to keep

COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

An extension entomologist shows an Illinois farmer how army-worms have stripped the leaves from his wheat. Aerial spraying with parathion was recommended.

its agents informed on the newest findings in agricultural research, on new programs and policies that affect agriculture, and new teaching techniques. To be successful, extension workers must like to work with people.

In most instances, specialists on the State staff are expected to have the master's degree and special training in their particular lines of work.

Employment Outlook

The Cooperative Extension Service has experienced a constant growth, and the demand for new extension workers continues. There are approximately 14,000 extension service workers in the United States. As agricultural technology becomes more complicated, there is an increasing demand by farmers for trained personnel to assist them in applying this technology. Moreover, as farm people become more aware of the need for organized activity, they make additional requests for increases in Extension Service personnel. Rural nonfarm families, including suburban residents, are also demanding more and more educational assistance from extension workers. These people are extending the work of the Extension Service to new segments of our population.

Counterparts of the Agricultural Extension Service are being established in many countries of the world and Extension Service personnel are often recruited to help initiate and organize these programs.

Earnings and Working Conditions

The salaries of extension agents vary from State to State and county to county. In October 1956, the average annual starting salary of assistant agricultural agents was about $4,000, and of home agents approximately $3,750; starting salaries for assistant agricultural agents ranged from $3,600 to $5,100.

The successful assistant agent ordinarily is promoted rapidly. This may occur in the county where employed as an assistant agent or through being shifted to a more responsible job in another county in the State. Top salaries for agricultural agents average around $8,000 a year, with a range of from $7,000 to $11,000. The top salaries of experienced home agents average $6,200 annually, with a range of from $5,200 to $9,500.

Hours of work are long and highly irregular. Many evenings are devoted to meetings with farmers and other groups. The work is of a highly responsible nature and agents must maintain good working relationships with both farmers and other segments of the community.

Where To Go for More Information

For additional information get in touch with County Extension Offices, State Directors of Extension located at each State College of Agriculture, or the Federal Extension Service, United States Department of Agriculture, Washington 25, D. C. See also statement on home economists (refer to index for page number).

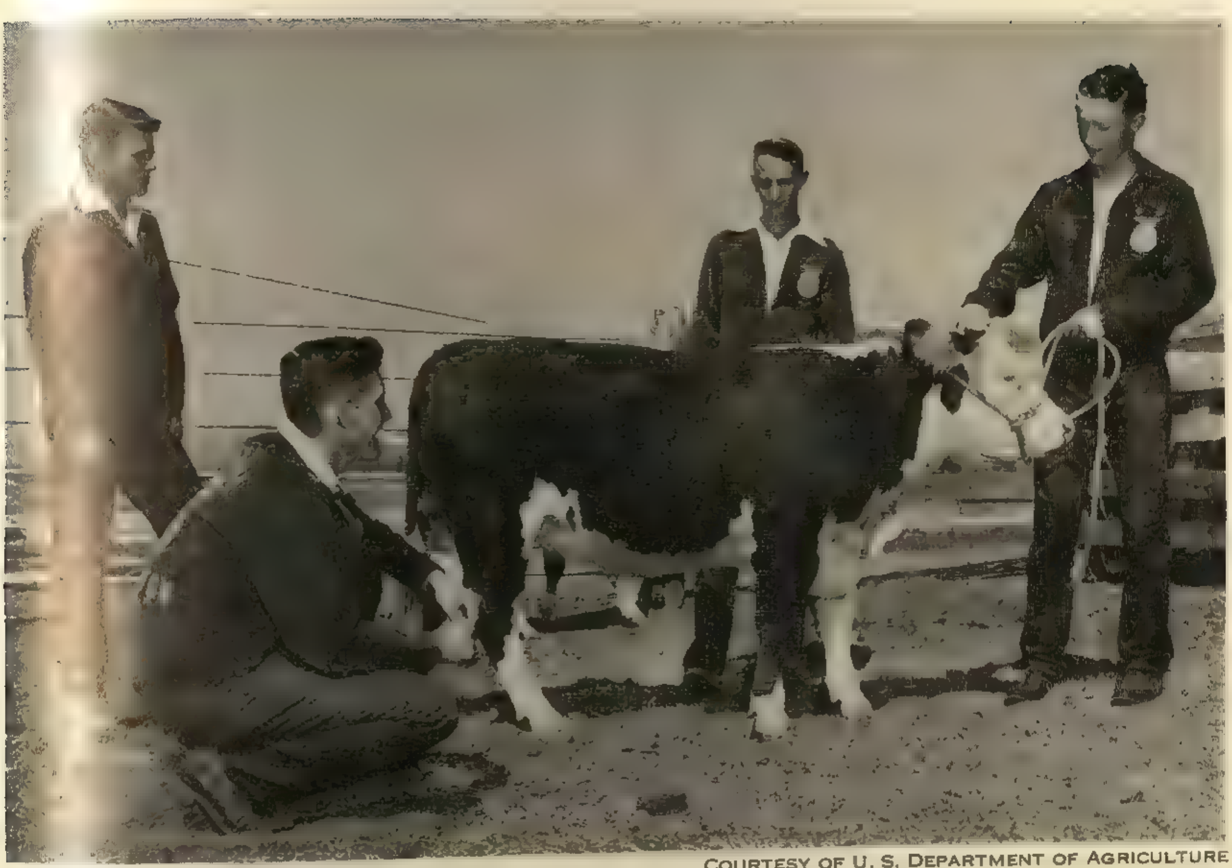
Vocational Agriculture Teacher

Nature of Work

Vocational education in agriculture is a nationwide, federally aided program of systematic instruction in agriculture and farm mechanics of less than college grade, conducted in public schools or classes for those persons over 14 years of age "who have entered upon or who are preparing to enter upon the work of the farm or the farm home." The program operates under a plan of cooperation between State Boards for Vocational Education and the Office of Education, U. S. Department of Health, Education, and Welfare.

For high school students, the teacher conducts classes in agriculture with subject matter selected to fit the needs of persons enrolled and of the particular community. Each student is required to conduct a farming program, either at home or on facilities provided by the school, with year-round supervision by the teacher. Students generally start with small farming programs but are encouraged to expand their enterprises as rapidly as they can so that by the time they have completed high school, they will have built up an investment in farming large enough to permit them to farm on a full-time basis or to enter upon a sound partnership agreement with parents.

Along with class instruction and supervision of farming programs, teachers of vocational agriculture give instruction in farm mechanics in school farm shops. Students learn the operation



COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

Vocational agricultural students are taught to select outstanding animals for their breeding herd.

and maintenance of farm machinery, utilization of electrical equipment, and construction of such equipment as farm water systems, feeders, brooders, fences, and small buildings.

The teacher of vocational agriculture also serves as advisor to the local chapter of Future Farmers of America, a private organization that engages in a wide variety of activities designed to improve students' leadership abilities and stimulate their interest in farming.

In addition to work with "in-school" students, vocational agriculture instructors also provide organized instruction for young farmers, which deals primarily with their problems in establishing an enterprise, and for adult farmers to help them to keep abreast of modern farming technology.

Where Employed

Vocational agriculture departments exist in rural high schools throughout the United States and in Hawaii, Puerto Rico, and the Virgin Islands. The largest of these schools may have several instructors on the vocational agriculture staff.

Training and Other Qualifications

Vocational agriculture teachers must be graduates of a specialized course of training given in approved agricultural colleges. The training includes classes in both technical agriculture and teaching methods. Students must elect to enter this curriculum not later than their junior year in order to get the comprehensive training that is required for this field.

An in-service training program is conducted to keep vocational agriculture teachers abreast of new agricultural and teaching developments.

Employment Outlook

The employment outlook in the field of vocational agriculture is very good. There were approximately 11,000 teachers in this field in 1956 and the number is increasing gradually. Some turnover among teachers occurs constantly, as

some go into farming for themselves, others go into business or professional work related to agriculture, and still others retire or die. The number of high schools offering vocational agriculture courses has been increasing as has the number of schools that employ more than one teacher in this field. Furthermore, expected increases in high school enrollment will be a factor favoring employment opportunities. (See the chart on high school enrollment on page 57.)

Earnings

The vocational agriculture teacher has 12 months' employment each year and this is reflected in his annual salary. Beginning salaries in 1956 averaged around $4,000 and ranged from $3,100 to $4,500. Top salaries ranged from $5,000 in some States to $8,700 in others. The average salary for all teachers was about $4,800. In addition, vocational agriculture teachers in most States are paid for official travel in supervising the programs of students and for other approved activities.

Where To Go for More Information

As salaries, travel, and programs of vocational agriculture teachers vary slightly among States, prospective teachers should consult with the Head Teacher Trainer in Agriculture Education at the land-grant college or the State Supervisor of Agricultural Education at the State Department of Public Instruction in their respective States.

See also statement on Secondary School Teachers (refer to index for page number).

Agricultural Research Workers

Nature of Work

The number of research activities related to agriculture has increased rapidly within the last several decades. Although the largest agencies in this field are the State Experiment Stations connected with the land-grant colleges and the various research branches of the U. S. Department of Agriculture, many other research organizations exist. Some of these engage in independent research; others are connected with companies that produce chemicals, equipment, and other supplies for farmers, finance their operations, or market their products.

The major lines of research in connection with agriculture include the following: Entomology and parasitology, bacteriology, plant breeding and pathology, forestry, animal pathology, animal and poultry husbandry, soils research and conservation, agricultural engineering, economics of production, financing and marketing, human nutrition, and statistical analysis.

Entomologists develop control measures against insects affecting crops, people, animals, and marketed agricultural commodities and study the utilization of beneficial insects.

Bacteriologists conduct microbiological and fermentation research to produce vitamins, antibiotics, amino acids, sugars, and polymers, by the action of micro-organisms.

Plant pathologists conduct research on the causes and control of diseases attacking crop plants, including those caused by fungi, bacteria, viruses, and physiological conditions.

Soils researchers work on methods of controlling soil erosion and improving land use.

Agricultural engineers develop new machines, devise new processing techniques, and plan new types of buildings that are more efficient.

Agricultural economists deal primarily with complex problems related to the production and marketing of farm products. They are fact-finders, evaluators, analysts, and interpreters who help farmers with economic affairs.

Where Employed

The majority of research positions in agriculture are connected with the U. S. Department of Agriculture, although agricultural researchers also work for other government agencies and for private industry. Research positions with the U. S. Department of Agriculture are located in various parts of the country. A large number are in Washington, D. C., or at the nearby Agricultural Research Center at Beltsville, Md. There are also four Regional Research Laboratories at Albany, Calif.; Peoria, Ill.; Wyndmoor, Pa.; and New Orleans, La. Much of the research staff of the Department of Agriculture is stationed at land-grant colleges but there are also numerous other places where research units are located. Experimental work by staff members is conducted in Puerto Rico, Alaska, Hawaii, Mexico, France,

Egypt, and other parts of the world. Many agricultural research jobs are found in other government departments.

Research workers associated with the experiment stations of the land-grant college system usually are stationed at the college, but many State colleges also have branch experiment stations at which specialized research is carried on; e. g., the branch station in Riverside, Calif., specializing in citrus research, the branch station at Stuttgart, Ark., specializing in research in rice production.

In 1956, approximately 8,000 research workers were employed in the land-grant colleges and about 6,000 in the U. S. Department of Agriculture. The business and other groups engaged in agricultural research probably employed about 8,000 workers. These figures include some research aides who are still working for their college degrees but who are also part-time employees on research projects. More than half of the research workers in land-grant colleges also spend part of their time in teaching.

Research by independent research organizations, foundations, and private business groups is developing in many parts of the country. These groups tend to be located either in industrial centers or in areas of high agricultural activity. These include producers of insecticides, herbicides, and other chemical dusts and sprays; producers of feed, seed, and fertilizer; and producers of mechanical equipment. Farm loan associations, banks, marketing associations, and other groups now employ research staffs to help guide their activities with farmers. It is estimated that approximately 2,000 such groups have agricultural research programs.

Training, Other Qualifications, and Advancement

College training is essential for research work today. The training of research workers is continually becoming more highly specialized. The field has become so broad that many colleges tend to specialize in particular lines of agricultural research work and training. The period of training is also lengthening, so that five or more years of college work are sometimes needed in order to attain the required proficiency.

Individuals who expect to enter this field of work should obtain a background in science and mathematics as early as possible. This will serve as a basis for making a decision as to which branch of research the student is best adapted to enter.

Although it is possible to enter most of these lines of research employment with a bachelor's degree, entrants should have in mind that they will probably have to go on to a master's, and perhaps a doctor's, degree in order to compete with other workers in the field.

Advancement for agricultural research workers depends on such considerations as the individual's productiveness, the quality of research, his ability to plan and organize research investigations, his ability to cooperate on investigative work, and the nature of his training.

Employment Outlook

The employment outlook in 1957 for agricultural research workers was good at all levels of training, and was expected to remain good for the next several years at least.

Agricultural colleges are unable to supply all the research workers needed in the field of agriculture. Science students must be recruited from other sources in order to fill the demand. Considerable competition exists between research agencies for workers with good potentialities, and the prospects are that this situation is likely to continue in the next few years.

Agricultural research has been a growing field of employment for several decades, as the value of research in agriculture has become increasingly recognized. Expenditures in support of such research by Federal and State Governments and by private organizations have increased in recent years, and this trend is expected to continue over the long run, creating employment opportunities for persons qualified to do research.

Earnings

Agricultural research workers frequently start as student assistants during the time they are obtaining their college training. Ordinarily, they are part-time workers who may be paid from $150 to $450 a month, depending on the amount of time they devote to their work. Others may do preprofessional work for the Department of Agriculture on a similar basis.

Entrance salaries for research workers on the staff of the Department of Agriculture depend

on both educational attainment and experience. The usual scale is as follows:

Bachelor's degree	GS–5 rating, $3,670 beginning salary.
Master's degree, or bachelor's plus 1 year's experience.	GS–7 rating, $4,525 beginning salary.
Doctor's degree, or master's plus 1 year's experience. Bachelor's degree plus 2 years' experience.	GS–9 rating, $5,440 beginning salary.

In some lines of work in which there is a shortage of workers, beginning salaries have been increased to $4,480 for GS–5 entrants, $5,335 for GS–7, and $6,115 for GS–9. Research workers now being paid at these higher rates include physicists, chemists, meteorologists, engineers (including agricultural engineers), metallurgists, geophysicists, electronic scientists, and mathematicians.

Top salaries in research work with the Department of Agriculture—about $12,000 to $15,000 annually—are paid to those people who combine research with administrative responsibilities.

Research workers in land-grant colleges sometimes are paid partly from Federal and partly from State funds, hence salaries vary from State to State. Actual cash salaries probably run slightly lower than those in the Department of Agriculture, but living costs may also run somewhat lower than in Washington, D. C., where many of the Federal jobs are located.

Where To Go for More Information

For additional information on research opportunities at land-grant colleges, contact the dean of agriculture at the land-grant college in your State. For information on employment in the United States Department of Agriculture, contact USDA recruitment representatives at the land-grant college or write directly to Office of Personnel, U. S. Department of Agriculture, Washington 25, D. C. For further information on research activities related to agriculture, see also statements on selected professional and technical occupations in this chapter and other chapters in this Handbook. See especially chapter on the Biological Sciences (refer to index for page numbers).

The following publications will be valuable:

Career Service Opportunities in the U. S. Department of Agriculture, U. S. Department of Agriculture, Division of Employment, Office of Personnel, October 1956.

1956–57 Opportunities for Employment in the Department of Agriculture, U. S. Department of Agriculture, Division of Employment, Office of Personnel, October 1956.

Careers Ahead, Association of Land-Grant Colleges and Universities, Washington, D. C. 1955.

Agricultural Economists

Nature of Work

Rapid changes in farm technology are creating new problems on both individual farms and in the economy as a whole. Farm operators are forced by economic competition to reorganize their enterprises so as to make the best use of new machines, new varieties of crops and livestock, and new methods. Increased farm production will complicate problems of marketing, prices, income distribution, and reorganization of productive efforts. In this broad field of study, the agricultural economist ordinarily works only in one special sector, for example, the marketing of livestock or of dairy products; the economics of producing eggs, broilers, or other farm products; the cost and return relationships in the application of fertilizer; the factors affecting the demand for soybeans, apples, or other types of farm products; cycles of cattle production and prices; the competitive position of cotton in the world market; or the price spread between the producer and the consumer of farm products.

The major fields of work of the agricultural economist are in research, teaching, and consultation. Some economists, however, use their training in economics as a background for farming or for business opportunities. They may do this either as operators or as specialized employees of large-scale farms, processing companies, or of organizations that provide goods and services for farmers. In the latter group are farm-implement companies; feed, seed, and fertilizer companies; chemical companies; banks; and farm loan agencies.

Where Employed

The largest group of agricultural economists is employed by the State agricultural colleges to

do research, teaching, and extension work. Many of these economists specialize in rather broad fields of study, such as farm management, production economics, prices, or marketing. The next largest employer of agricultural economists is the U. S. Department of Agriculture, which uses them in somewhat more specialized fields of inquiry, such as farm costs, land tenure, feeds and feeding, livestock production, poultry production, labor requirements, farm finance, crop estimates, marketing, merchandising methods, farm prices, disposal of farm surpluses, and improvement of incomes on small-scale farms. The Department also uses economists in many of its action programs in which they engage in administrative and regulatory work.

Although these are the two largest employers of agricultural economists, many other organizations also employ such personnel. These include State Departments of Agriculture, Federal Reserve Banks, conservation and reclamation districts, farm cooperatives, and other farm organizations. To these may be added a long list of private concerns, such as banks, insurance companies, feed and fertilizer companies, farm machinery manufacturers, and packers of meat and other food products. Employment of agricultural economists in farming and by companies that provide services to farmers is constantly increasing. Many agricultural economists are now being called on for advisory work in connection with rural development programs in foreign countries. Some go on brief assignments to meet particular problems; others make foreign service in one or more countries a career.

Training

The person who qualifies for work in this field should have a minimum of a bachelor's degree with courses in both agriculture and agricultural economics. Practically all the land-grant colleges provide the special training that is needed; other colleges may also offer sufficient courses to provide an adequate foundation. The particular courses taken may depend on the type of work done but, in general, they should include work in production economics, statistics, farm management, marketing, farm finance, and land economics. This is a rapidly developing profession, and those who wish to progress in the more technical fields of agricultural economics should plan to continue their education toward the master's and doctor's degrees.

Employment Outlook

The current demand for well-qualified agricultural economists exceeds the supply. This situation is due partly to increased demands for people with this type of background in business, industry, and foreign service. At present, too, there are special projects in the United States Department of Agriculture that call for additional personnel. These include marketing research, rural development activities, and soil bank programs. The prospect is for continued expansion of this field. As agriculture becomes more commercial and technical, the need for carefully trained economists becomes greater.

Approximately 3,000 agricultural economists were employed in this country in 1956, of whom about 1,500 were employed by land-grant colleges and the United States Department of Agriculture. Of these, about 750 were engaged in research while the rest were engaged in teaching, administrative, regulatory, and other types of work.

Earnings

The salaries of research workers employed by land-grant colleges and the U. S. Department of Agriculture have been discussed in the statement on agricultural research workers (p. 648). These will serve as a guide to entrance and average salaries of agricultural economists in the land-grant colleges and in the U. S. Department of Agriculture. Private companies frequently offer higher rates of pay. Positions in United States agencies in foreign countries ordinarily also are at rates substantially above those for jobs in this country.

Where To Go for More Information

For additional information about opportunities in agricultural economics, check with the Department of Agricultural Economics in the land-grant college in your State. For information on Federal employment opportunities, get in touch with USDA Recruitment Representatives at your land-grant college or write directly to the Office of Personnel, U. S. Department of Agriculture, Washington 25, D. C.

See also statement on economists (refer to index for page number).

Agricultural Finance Workers

Nature of Work

Credit has become an important aid to farmers in acquiring and operating farms. A large volume of long-term farm mortgage loans are made each year to assist farmers in buying, improving, and equipping farms. Similarly, a large volume of short-term or intermediate-term loans are made to farmers to finance current farm operations and to purchase livestock and equipment. A large share of these loans are made by commercial banks, life insurance companies, and specialized institutions that finance farmers.

In making loans to farmers, lending institutions need the services of men with broad training in agriculture and business. This training ordinarily requires practical farm experience as well as academic training in agriculture, economics, and other fields. Making loans on a sound basis involves careful analysis of the farm business and proper valuation of farm real estate and other farm property. Trained personnel in lending institutions, therefore, are the key to sound credit practices in financing farmers.

Where Employed

1. *Farm Credit Institutions.* The banks and associations that operate under the supervision of the Farm Credit Administration in Washington, D. C., are the major institutions that finance agriculture. Under this program the country is divided into 12 districts, with headquarters located in:

Springfield, Mass.	St. Paul, Minn.
Baltimore, Md.	Omaha, Nebr.
Columbia, S. C.	Wichita, Kans.
Louisville, Ky.	Houston, Tex.
New Orleans, La.	Berkeley, Calif.
St. Louis, Mo.	Spokane, Wash.

Each district has a Federal land bank, a Federal intermediate-credit bank, and a bank for cooperatives. These banks require men who are qualified to handle loans to farmers and, in the case of the banks for cooperatives, to farmers' cooperative associations. An important group of employees are the land appraisers who are paid by the Federal land banks but are in the Federal Civil Service and are appointed by the Farm Credit Administration. Also, in each district there are national farm loan associations through which land-bank loans are made and production credit associations which make short-term and intermediate-term loans to farmers. Throughout the country, there are approximately 500 production credit associations and 1,000 national farm loan associations.

2. *Country Banks.* In recent years, many country banks have employed men to handle loans to farmers and to maintain contacts with farmers. Usually, these men must have farm backgrounds and technical training in agriculture. Country banks all over the country are adopting the practice of employing agricultural specialists.

3. *Farmers Home Administration.* The Farmers Home Administration, with headquarters in Washington, D. C., makes real estate and production loans as well as certain emergency loans to farmers who cannot qualify for credit from regular sources. In agricultural counties in most parts of the country, the Farmers Home Administration has a county supervisor who makes and services the loans in his territory. These men must have an agricultural background and training and be qualified to assist farmers in planning their farm business and in adopting proper farm practices.

4. *Life Insurance Companies.* Many of the major life insurance companies have substantial investments in farm mortgage loans and require men in their home offices as well as in the field to carry on the work of making and servicing loans. A technical background in farming is desirable for these positions.

Training, Other Qualifications, and Advancement

In the field of agricultural finance, practical knowledge of farming, as well as technical training in agriculture, is desirable. To qualify for such positions, therefore, a man should acquire practical experience in farming and preferably take a 4-year course at an agricultural college. The curriculum should provide training in agricultural economics, including courses in farm management, farm finance, land economics, marketing, and accounting. Technical courses in crop

and livestock production and soil management are also important.

In many instances, it will be necessary for young men to enter agricultural credit institutions as trainees or to begin in loan associations as field representatives or assistant secretary-treasurers. From these positions, they will have opportunities to advance to the higher positions in district credit institutions and to positions as secretary-treasurers (managers) in national farm loan associations and production credit associations. Men selected for agricultural work in country banks ordinarily must have had previous experience, such as work in agricultural extension or other work with farmers.

Employment Outlook

While the total number of persons employed in agricultural finance is not particularly large, there are career opportunities for a fairly large number of men desiring to enter this field. Agriculture is becoming more technical and the capital invested per farm is increasing materially. Thus, financing of farms is becoming more technical and requires greater skill. In the future, greater emphasis will be placed on technical training as a qualification for positions in this field.

Earnings and Working Conditions

No standard pattern of salaries prevails in the agricultural finance field. For example, among national farm loan associations and production credit associations, there is a wide range in the volume of loans and in the financial position of the associations, and this influences the number of employees and the salaries paid. The salaries paid to secretary-treasurers of these associations range from approximately $3,000 to $12,000; a large proportion of the secretary-treasurers receive salaries that range from $5,000 to $8,000. County supervisors under the Farmers Home Administration receive salaries that range approximately from $3,600 to $6,200 per year, with an average of approximately $5,000. Salaries paid by country banks differ even more widely.

Working conditions in the field of agricultural finance generally are attractive. The banks and associations are located in the larger cities and the larger country towns in agricultural areas where living conditions generally are favorable. The work requires travel in the field to contact farmers, and this work is usually pleasant and constructive.

Where To Go for More Information

Inquiries on opportunities for employment in the field of agricultural finance may be directed to the following:

Farm Credit Administration, Washington 25, D. C.

Farm Credit District—Springfield, Mass.; Baltimore, Md.; Columbia, S. C.; Louisville, Ky.; New Orleans, La.; St. Louis, Mo.; St. Paul, Minn.; Omaha, Nebr.; Wichita, Kans.; Houston, Tex.; Berkeley, Calif.; Spokane, Wash.

Farmers Home Administration, U. S. Department of Agriculture, Washington 25, D. C.

Agricultural Director, American Bankers Association, 12 East 36th St., New York 16, N. Y.

See also chapters on Banking Occupations and Insurance Occupations (refer to index for page numbers).

Agricultural Engineers

Nature of Work

During the last two decades, the efforts of agricultural engineers have been directed largely to the engineering design of tractors and farm equipment, design of farm structures, utilization of electrical energy on farms, soil and water conservation and management, and processing of agricultural products for the market. In these specialties, the agricultural engineer uses basic engineering principles and concepts to help achieve greater production per farmworker with fewer man-hours per unit of produce, at a greater return to the farmer and improved quality for the consumer. Specific areas of work involve research, education, production, design, development, testing, and application, production engineering, sales engineering, maintenance, management, or some combination of these.

Where Employed

Private business organizations employ approximately 60 percent of the agricultural engineers in the United States and the rest are engaged in public service work.

Agricultural engineers are employed by more than 1,000 private business organizations, ranging from very large manufacturers to individually owned small businesses. These include farm-equipment manufacturers who produce tractors and related farm equipment; smaller and more specialized manufacturers of field, barnyard, and household equipment; producers of electrical, mechanical, and structural component parts and basic component materials having agricultural applications; electric service companies; distributors and dealers in farm equipment and supplies; trade associations; specialized agricultural producers and processors; publishers; advertising agencies; consulting engineers; and engineering and management services for farmers. Some agricultural engineers are self-employed as owners or partners in some of the above types of business.

Among government agencies, the U. S. Department of Agriculture is the largest single employer; the Department's Soil Conservation Service and the Agricultural Research Service are the largest users of agricultural engineers. The U. S. Department of the Interior and the Department of Defense use smaller numbers, and several other Federal agencies each use a few. Individual States also employ agricultural engineers, most of whom are affiliated with the agricultural engineering departments of the State colleges, universities, experiment stations, and extension services. Some are employed by other State agencies concerned with natural resources, food sanitation, pollution control, highways, soil conservation, and other work related to State interests in public welfare, business, and agriculture. A few agricultural engineers work for counties, cities, and special districts organized on the basis of drainage, irrigation, public power, and soil conservation problems.

Employment Outlook

In addition to the immediate shortage of well-qualified agricultural engineers, several factors contribute to favorable long-range employment outlook for agricultural engineers in a broadening field. In 1956, the ratio of agricultural engineers to farm workers was only 1 to 1,500 compared with 1 engineer to less than 100 production workers in some other industries. Also, engineers have proved their worth, especially in improving man's capacity to deal effectively and economically with the high tonnages, large volumes, tremendous energies and power requirements, accurate environmental controls, and precision operations that are characteristic of the modern farm. These major factors in the cost and quality of agricultural production are open to much further improvement through agricultural engineering. They present immediate major opportunities for additional engineering service to agriculture.

The agricultural engineer looks forward to growing opportunity to make farmwork easier, more productive, and more economical. He can use the whole range of physical and biological sciences, to tool up agriculture so as to insure the more complete development and realization of human resources. Thus, the agricultural engineer can contribute to the production of better foods and other organic products, in wider variety and better quality, at lower cost, with better balance in relation to demand, for wider use, and with conservation of agricultural resources.

Training and Other Qualifications

Most agricultural colleges offer some courses in agricultural engineering, and several have departments offering bachelors' and advanced degrees in agricultural engineering. A bachelor's degree in some branch of engineering is usually required for employment in this field. Only agricultural engineers are employed in some jobs. However, in some specialized jobs, persons with degrees in other branches, such as architectural engineering, may be employed in agricultural work. (See also chapter on Engineering for requirements in the general field of engineering; refer to index for page number.)

Earnings

Agricultural engineering salaries are comparable with those in other branches of engineering. As in other engineering fields, salaries of agricultural engineers are affected greatly by training, experience, and proved ability. Starting annual salaries ranged from \$3,500 to \$5,500 in 1956 and salaries for qualified senior engineers from about \$8,000 to \$12,000. Salaries are much higher

for chief engineers and engineers who have advanced to executive or managerial positions.

Where To Go for More Information

Information on schools and scholarships may be obtained from:

State Agricultural Colleges
The American Society of Agricultural Engineers, St. Joseph, Mich.

Information on Federal employment may be obtained from:

United States Civil Service Commission, Washington 25, D. C.

Office of Personnel, U. S. Department of Agriculture, Washington 25, D. C.

Local county offices of the Soil Conservation Service, U. S. Department of Agriculture.

See also chapter on Engineers (refer to index for page number).

Soil Scientists

Nature of Work

Soil scientists are trained to determine the physical, chemical, and biological characteristics and behavior of soils. They investigate soils in the field and in the laboratory and classify them into homogeneous units in accordance with a national system of soil classification. From the study of their characteristics and through research, soils can be defined in terms of their responses to management practices and capabilities for producing crops, grasses, and trees, as well as their behavior as engineering materials. Soil scientists prepare maps, usually based on aerial photographs, on which the individual kinds of soil and other landscape features significant to soil use and management are plotted accurately in relation to land lines, field boundaries, roads, and other conspicuous features.

Soil scientists also conduct research to determine the physical and chemical properties of soils and their water relationships in order to understand their behavior and origin. They predict the yields of cultivated crops, and of grasses and trees, that can be produced under alternative combinations of management practices, both extensive and intensive.

The field of soil science offers opportunities for those who wish to specialize in soil classification and mapping, soil geography, soil chemistry, soil physics, soil microbiology, and soil management. Training and experience in soil science also fit individuals for positions as farm managers, plantation managers, land appraisers, and many other professional positions.

Where Employed

Most soil scientists are employed by agencies of the Federal Government, State experiment stations, and colleges of agriculture. However, many soil scientists are employed in a wide range of other public and private institutions, including fertilizer companies, private research laboratories, insurance companies, banks and other lending agencies, real estate firms, land appraisal boards, State highway departments, State and city park departments, State conservation departments, and farm management agencies throughout the United States and its Territories. A few operate independent consulting businesses. An increasing number of American soil scientists are employed as research leaders, consultants, and agricultural managers in foreign countries.

Training and Advancement

Training in a college or university of recognized standing is important in obtaining employment as a soil scientist. A B. S. degree is a minimum requirement for entrants in the field of soil science. Those with graduate training, especially with a doctor's degree, can be expected to advance rapidly into responsible positions with good pay. This is particularly true in soil research, including the more responsible positions in soil classification, and in teaching. Soil scientists who are able to deal with both field data and laboratory data have a special advantage.

Many colleges and universities offer fellowships and assistantships for graduate training or employ students for part-time teaching or research.

Employment Outlook

Opportunities for well-trained soil scientists were excellent in 1955 and 1956; these are expected to continue to increase for several years. A large number of good postions are vacant now because of the shortage of qualified soil scientists.

There is increasing demand for soil scientists to help complete the scientific classification and evaluation of the soil resources in the United States. One of the major program objectives of the Soil Conservation Service of the U. S. Department of Agriculture is to complete the soil survey of all rural lands in the United States. This program includes research, soil classification and correlation, the interpretation of results for use by agriculturists and engineers, and the training of others in the use of the results. Also, demand is increasing for both basic and applied research to increase the efficiency of soil use on a sustained basis.

Earnings

The income of soil scientists depends upon the amount of responsible work they can do. This in turn depends upon their educational background, professional experience, and individual abilities.

Entrance salaries in the Federal service for soil scientists with a B. S. degree are approximately $300 per month, with advancement to $375 per month after one year of satisfactory performance. Beyond that, advancement depends upon the ability of the soil scientist to carry on high quality work and to accept responsibility. Earnings of well-qualified soil scientists with several years' experience range up to $1,000 per month.

Where To Go for More Information

Additional information may be obtained from the United States Civil Service Commission, Washington 25, D. C.; Office of Personnel, United States Department of Agriculture, Washington 25, D. C.; or any office of the Department's Soil Conservation Service.

See also statement on chemists and biologists (refer to index for page numbers).

Soil Conservationists

Nature of Work

Soil conservationists are trained to give farmers, ranchers, and others technical assistance in planning, applying, and maintaining soil and water conservation measures and structural improvements on individual holdings, groups of holdings, or on watersheds. Farmers and other managers of land apply this technical assistance by making adjustments in land use; protecting land against soil deterioration; rebuilding eroded and depleted soils; stabilizing runoff and sediment-producing areas; improving cover on crop, forest, pasture, range, and wildlife lands; conserving water for farm and ranch use and reducing damage from flood water and sediment, and by draining or irrigating farms or ranches.

The land owner or operator has the responsibility for resolving problems concerning land use and treatment raised by his farm or ranch conservation plan. In reaching his decisions, however, he can take advantage of the reliable technical information which the soil conservationist can provide. These technical services are as follows:

1. Maps presenting inventories of soil, water, vegetation, and other details that are essential in conservation planning and application.
2. Information on what the proper land uses are and what treatment is suitable for the planning use of each field or part of the farm or ranch, groups of farms or ranches, or entire watersheds.
3. The relative cost of, and expected return from, various alternatives of land use and treatment.

After the landowner or operator decides upon a conservation program that provides for the land to be used within its capability and treated according to the planned use, the relevant facts are recorded in a plan which, together with the maps and other supplemental information, constitute a *plan of action* for conservation farming or ranching. The soil conservationist then gives the land manager technical guidance in applying the conservation practices and in maintaining them.

Where Employed

Most of the soil conservationists are hired by the Federal Government, mainly by the U. S. Department of Agriculture's Soil Conservation Service and the Bureau of Indian Affairs in the Department of Interior. Some are employed by colleges and State and local governments; others work for banks and public utilities.

Training and Advancement

A bachelor's degree is the minimum requirement for professional soil conservationists. A col-

COURTESY OF U. S. DEPARTMENT OF AGRICULTURE

A soil conservationist prepares a use-capability soil map for a farm.

lege degree is not required for subprofessional soil conservationists whose primary work is that of giving farmers or ranchers assistance in applying conservation practices after conservation planning has been done.

Thorough training in a college or university of recognized standing is necessary in securing employment. Those with degrees in the following specialties are eligible to become soil conservationists after special field training in farm and ranch conservation and land use planning: forestry, biology, agronomy, engineering, range, general agriculture.

Those who show unusual aptitude in the various phases of the work have good chances of advancement into higher salaried technical and administrative jobs.

Employment Outlook

Employment opportunities for well-trained soil conservationists were good in 1956. There are frequent openings in most parts of the country because of the normal turnover in personnel. Opportunities in the profession will expand because of increasing interest in conservation by Government agencies, public utility companies, banks, and other organizations which are adding conservationists to their staffs. It is likely that there will be a number of new openings in this field in college teaching, particularly at the undergraduate level.

Earnings

The entrance salary for soil conservationists with a BS degree employed by the Federal Government is approximately $300 per month, with advancement to $375 per month after one year of satisfactory service. Subsequently, advancement depends upon the individual's ability to advance to positions of greater responsibility. The top salaries in this field in the Federal service range from $10,000 to $12,000 per year.

The entrance salary in private employment depends upon the individual's education and experience, with the upper limits set by his ability and initiative.

Where To Go for More Information

Additional information on employment as a soil conservationist may be obtained from the United States Civil Service Commission, Washington 25, D. C.; Employment Division, Office of Personnel, U. S. Department of Agriculture, Washington 25, D. C.; or any office of the Department's Soil Conservation Service.

Other Professional Work

There are numerous other professional opportunities for people trained in agriculture but these are discussed below in less detail. These opportunities include: Inspection, grading, and marketing of farm products; work with agencies that prevent the spread of plant pests, animal parasites, and diseases; management of farm cooperatives and other organizations of farmers, and large scale farms or ranches; organization of farm management and other professional services for farmers; wildlife management and control; and agricultural communications.

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The qualifications of workers in these fields ordinarily include a college education with special training in the particular line of work. Inspectors of fruit and vegetables and workers engaged in pest control ordinarily must be qualified as entomologists or parasitologists, inspectors of dairy products as bacteriologists, and inspectors of meat and poultry products as veterinarians. They work with marketing specialists who interpret and enforce marketing agreements and regulations. Preparation for many professional jobs in agriculture calls for training in agricultural economics. Both the management of the individual farm enterprise and that of farm cooperatives are also facilitated by work in agricultural economics.

Another growing field of specialization is that of agricultural communications. A staff of market news reporters is employed by the U. S. Department of Agriculture in 125 field offices over the United States to report on the movement of agricultural produce from the farm to the market. Radio farm directors are employed by many radio stations to report prices, sales, grades, and other agricultural information to farm people. Agricultural reporters and editors compile and publish a wealth of farm news and data for farm journals, farm bulletins, and farm broadcasts.

The demand for workers in most of these fields exceeds the supply. In recent years, the demand has been increased by the recruitment of professional personnel to staff agricultural missions to give technical aid to farmers in other countries.

Farm Service Jobs

In almost every type of agriculture, there are specialized services which an individual can learn readily and perform for farmers. A person can enter many of these either as an employee or as an independent operator. Some of these services require an extensive outlay of capital but others require very little. Some are highly seasonal whereas others can be rendered the year-round. These services can sometimes be combined well with operation of a small farm.

Services that provide employment on a year-round basis include the following: Cow testing, artificial breeding service, whitewashing service, livestock trucking, and well drilling.

In cow testing and artificial breeding work, an association of farmers employs one or more workers on a monthly basis to conduct the operations. Supervisors who do cow testing are employed by dairy herd improvement associations. They must have a high school education, and a farm background is almost essential. In 1956, annual salaries ran from about $3,000 to $4,200. Artificial breeding associations employ inseminators who must have at least a high school education. In 1956, these workers were paid from about $4,800 to $7,200 a year. Agricultural college training is desirable but not essential for employment in these occupations. Brief periods of approximately a month of specialized training for these occupations are available through the associations. Individuals ordinarily set up the whitewashing, trucking, and well-drilling services and employ such assistants as they need.

Other services performed for farmers are of a more seasonal nature. These include: Fruit spraying (2–3 months), airplane dusting (4–6 months), grain combining (2 months), hay and straw baling (2–8 months), tractor plowing and cultivating (4–6 months), and sheep shearing (2–3 months).

These and many other services are often done by farmers who wish to keep their equipment busy and therefore engage in custom work as a sideline. In areas with a long growing season, however, the period when these services can be carried on will be long enough to permit individuals to specialize in them.

Somewhat more remote from farm operation but still closely tied in with agriculture are such vocations as: Repair and servicing of farm machinery; feed grinding and mixing; storage and warehousing of agricultural products; operation of nurseries and greenhouses; and packing, grading, and processing of farm products.

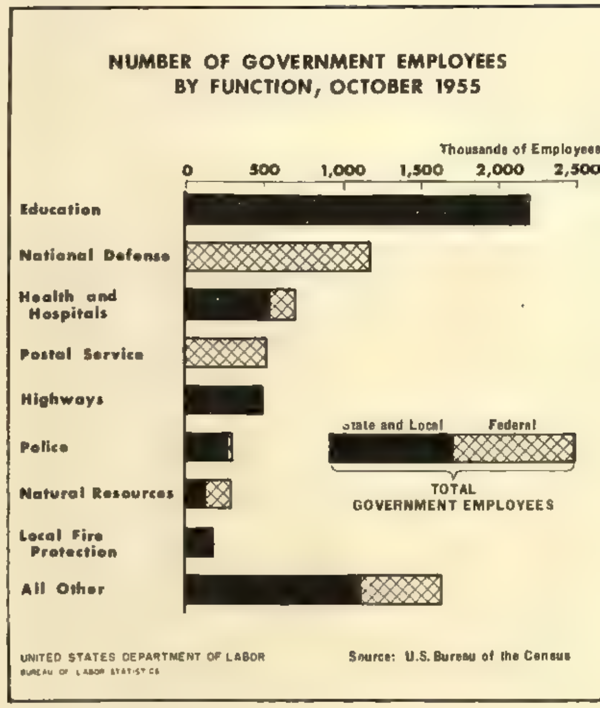
These activities are sometimes performed on the farm, but the tendency has been for them to move away from the farm and be carried on as specialized lines of business. An agricultural background is helpful to people who enter these lines of work. The agricultural aspects can be learned more readily than the specialized skills that are required in these lines of work.

Government Occupations

Government is one of our largest fields of employment. One worker out of every nine in the United States is employed by a government agency—Federal, State, or local. In some States, where manufacturing or other nonfarm industries have developed less than in the United States as a whole, employment in Federal, State, or local government agencies constitutes a significant part of all nonfarm employment; in several western States more than 1 out of 4 nonfarm employees works for a government agency. Government jobs are to be found not only in every State, county, and city, but even in smaller towns; in lonely lighthouses off the seacoasts; and in forest ranger stations at the tops of the highest mountains.

More than two-thirds of the government workers are employed by State and local governments; the rest work for the Federal Government.

CHART 68



Government Activities and Occupations

Government service offers opportunities for workers in many different occupations. Among the 7 million people employed by government agencies are workers in every major group of occupations—even a few sales workers and farm workers—although the relative number of employees in the various types of occupations is much different from that found in private industry.

Only about 1 in 15 government employees is doing what many people think of as "government work"—collecting taxes, general administration, legislative and judicial work, recording documents, supervising elections, and the like.

By far the greatest number of government employees are engaged in education. More than 2 million, or 29 percent of the government workers, are in this field—nearly all of them working in schools and colleges supported by State and local governments (chart 68).

The second largest group of government workers—more than a million, or 15 percent of the total—is engaged in national defense activities of the Federal Government. These are the civilian employees of the Department of Defense, and a few other defense-related agencies such as the Atomic Energy Commission. They include administrative and clerical employees, scientists and engineers, manual workers in Navy yards and arsenals, and a wide variety of other kinds of workers. Employees of military hospitals and of schools run by the military services are included here.

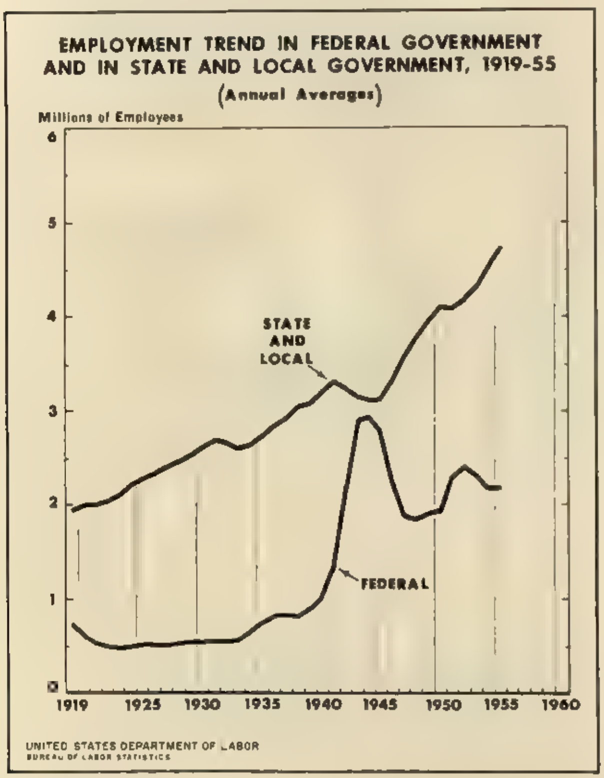
Most of the government workers in the health and hospital fields, highway work, and police and fire protection activities are in State and local government agencies. On the other hand, the postal service is, of course, Federal, and so are most of the jobs connected with natural resources, such as those in the National Park Service.

Among the major activities listed in the chart under "all other" are public welfare, sanitation, utilities, State liquor stores, and employment security. One can see just from the listing of these activities the many different occupations for which there is employment opportunity in government.

Employment Trends

The number of people working for government has been growing with the growth of the Nation. Government employment was only about 2½ million in the early 1920's (chart 69); since that time the number of government workers has nearly tripled, while the total number of employees in private industry and business has little more than doubled.

CHART 69



State and local government employment has risen steadily, except during the early depression years, when budgets were being cut, and during World War II. Growing population and rising standards of government services in the fields of education, health, welfare, highways, and police and fire protection created the need for more and more employees. By 1956, State and local governments had 4¾ million people working for them—more than twice as many as in 1920, while the population rose by only 55 percent during the same period.

In contrast to the steady growth of State and local government, Federal Government employment has grown in rapid spurts in response to national emergencies. The number of Federal workers remained fairly stable during the 1920's, but rose by about 45 percent from 1933 to 1936 as government activities expanded to cope with the severe economic depression. With World War II, defense and economic stabilization activities expanded sharply; total Federal Government employment tripled—from less than 1 million in 1940 to nearly 3 million in 1944. After a drop of over 1 million in the postwar period, Federal employment stabilized for a few years at under 2 million—about double the prewar level. The major part of this increase over prewar employment occurred in the Department of Defense, which was maintaining an Armed Forces (not included in these figures) about three times as large as before World War II. The next spurt occurred during the Korean emergency when the Armed Forces more than doubled and Federal employment rose by a half million. Since Korea, though the military forces have been maintained at twice the pre-Korea level, Federal employment has dropped by about half as much as it had increased.

Over the past 30 years, therefore, while State government employees more than doubled, Federal Government increased its staff more than fourfold, primarily because of the need for a stronger defense establishment, but also because of the more important role the United States plays in world affairs and the greater activity of the Federal Government in such fields as agriculture, social security, conservation and flood control, veterans' services, and the regulation of interstate commerce.

On the basis of past trends, a continued steady increase in State and local government employment seems likely, since the population is expected to grow rapidly. A particularly rapid employment increase is likely in educational services as a result of the rising school-age population. The outlook for Federal Government employment is more difficult to assess because the number of Federal workers appears to be affected more by national emergencies than by domestic programs.

Civilian Employment in Federal Government

The Federal Government employs more workers than any other single employer in the United States. In June 1956, its establishments in the 48 States and the District of Columbia employed 2,193,000 civilian workers—about 4 per cent of all nonagricultural workers in the Nation.

Civilian employees of the Government are engaged in most of the occupations found in private industry—accounting, physics, engineering, medicine, stenography, skilled trades, truckdriving, and elevator operation, to cite a few illustrations. Some workers are also employed in occupations peculiar to the Federal Government, such as border patrolman, internal revenue agent, and mail carrier.

The wide range of civilian employment opportunities in the Federal Government is indicated by a study of the occupations of Federal white-collar workers in the continental United States, conducted by the U. S. Civil Service Commission in August 1954. Among the 163,000 Federal professional workers covered in this survey, about 43,000 worked in the engineering fields, 32,000 in medicine and allied fields, 20,000 in the physical sciences, 16,000 in the biological sciences, 12,000 in accounting and fiscal work, 10,000 in legal and related work, 9,000 in the social sciences, 7,000 in education, and 5,000 in mathematics and statistical work. The remainder were in such diversified fields as library and archives, veterinary science, fine and applied arts, copyright, patent and trademark work, and personnel administration and industrial relations. Among the 1,147,000 nonprofessional white-collar workers surveyed, about 724,000 were employed in the general administrative, clerical, and office services fields (including postal service); 79,000 in supply work; 71,000 in the accounting and fiscal fields; 53,000 in the inspection and investigation fields; and 42,000 in the medical and allied fields. The other nonprofessional white-collar workers were employed in a wide variety of fields such as engineering, physical and biological sciences, personnel administration and industrial relations, mathematics and statistics, and transportation, to name a few. About 1 out of 3 white-collar jobs were held by women in 1954.

In addition to the many white-collar occupations in the Federal Government, more than 600,000 Federal workers were employed in hundreds of different trades and manual occupations. The bulk of these "blue-collar" occupations were found in Federal establishments outside of Washington, D. C., such as shipyards, arsenals, air bases, quartermaster depots, construction projects, and harbor, flood-control, irrigation, or reclamation projects.

The following tabulation, based on a study made by the Bureau of Labor Statistics, shows the proportion of Federal employees in the continental United States in each of eight major occupational categories in 1954. The tabulation also shows the proportion of all nonagricultural workers in the United States in each category.

	Percent of—	
	Federal Government employees in the United States	*All nonagricultural employees in the United States*
All categories	100.0	100.0
Professional and technical	11.8	9.8
Managerial	7.0	10.5
Clerical	44.1	14.6
Sales	(1)	8.6
Skilled	13.8	13.2
Semiskilled	8.5	22.9
Service	5.6	12.0
Unskilled laborers	9.1	8.4

1 Less than 0.02 percent.

NOTE: Because of rounding, percents do not add to total.

Clerical workers held about 44 percent of all Federal jobs, compared with about 15 percent of the jobs in all nonfarm industries. About 12 percent of the Federal employees were in professional or technical jobs while about 10 percent of all nonfarm workers were in such occupations.

The large percentage of Federal employees in clerical occupations assumes further significance when one considers that about 1 out of every 9 clerical workers in the Nation was employed by the Federal Government in 1954. In each of 3 other categories—professional and technical, skilled craftsmen, and unskilled nonfarm laborers—at least 1 out of every 25 workers was employed by the Federal Government. Federal workers made up a much smaller proportion of the nonagricultural workers in the other major occupational categories.

Employment in the Executive Branch

A vast majority of the civilian workers in the Federal Government are employed by the more than 70 departments and agencies which make up the executive branch—about 99 percent in June 1956. The other 1 percent of Federal civilian workers were employed in the legislative and judicial branches. The executive-branch departments and agencies are responsible for such services as: Maintaining the flow of supplies and equipment to the Armed Forces, delivering mail, conducting scientific research, conserving natural resources, enforcing Federal laws, handling international relations, treating and rehabilitating disabled veterans, and administering other programs aimed to promote the health and welfare of the American people. To perform these and many other vital services too numerous to list here, the Government requires a continuous influx of workers in many occupations. Several hundred thousand job openings arise each year as a result of deaths, retirements, and resignations from Federal employment, and additional workers are often needed when new or expanded programs are authorized by Congress.

Most Federal workers are employed by three large agencies: Department of Defense, including the Departments of the Air Force, Army, and Navy; Post Office Department; and the Veterans Administration. These agencies employed about 79 percent of the 2,372,000 civilian workers of the executive branch in all areas, including overseas installations, in June 1956. The Department of Defense employed almost half of all civilian workers in the executive branch; the Post Office Department, about 21 percent; and the Veterans Administration, approximately 7 percent. The remaining 21 percent of the civilian executive branch employees handled the many other services performed by other Government agencies such as the Departments of State, Commerce, Labor, Agriculture, Interior, and Justice.

Federal employees are stationed in all parts of the United States, in its Territories and possessions, and in many foreign countries. Although most Government departments and agencies have their headquarters offices in the Washington, D. C. metropolitan area, fewer than 1 out of 10 Federal workers were employed in this area in June 1956. The State of California, with almost 233,000 executive-branch employees, had slightly more than the Washington, D. C. metropolitan area. Other States with more than 100,000 executive-branch workers included New York (185,000), Pennsylvania (134,000), Texas (119,000), and Illinois (101,000).

The Merit System

In order to make sure that hiring is done on the basis of individual merit, the Congress passed the Civil Service Act. About 85 percent of the jobs in the Federal Government in 1956 were covered by this act. It provides for competitive examinations and the selection of new employees from among those who make the highest scores in the examinations. The Civil Service Commission administers the Civil Service Act. In this capacity, it is responsible for conducting examinations and supplying Federal departments and agencies with names of persons who are eligible for the jobs to be filled.

Many Federal jobs are excepted from Civil Service requirements either by law or by action of the Civil Service Commission. However, a large percentage of the excepted positions are under separate merit systems of other agencies, such as the Foreign Service of the Department of State, the Department of Medicine and Surgery of the Veterans Administration, the Federal Bureau of Investigation, the Atomic Energy Commission, and the Tennessee Valley Authority. These agencies establish their own standards for the selection of new employees.

Civil Service competitive examinations may be taken by all persons who are citizens of the United States, or owe allegiance to the United States, and who meet requirements relating to such matters as age, physical ability, training, and experience. Examinations vary in nature according to the types of positions for which they are held. Some examinations include written tests; others do not. In those examinations which do not include written tests, applicants are rated according to the information they furnish on their training, experience, and skills.

There must be job vacancies or expected job vacancies before the Civil Service Commission will open an examination to the general public and accept applications. When vacancies exist or are expected, the Commission issues an examination

"announcement" which tells about experience or training requirements, location of jobs, duties, pay, forms that must be filed, and when and where examinations will be held. After the examination is announced, applications are accepted as long as the examination is open. Even after an examination is closed, some persons are permitted to file applications. Thus, persons who cannot file their applications before the examination closing date, because they are in military service or because they are working overseas for a Government agency or for an international organization such as the United Nations, may file not later than 120 days after honorable discharge or after return from abroad. Other persons who may file their applications after an examination closing date are those that have been granted "10–point veterans preference" by the Civil Service Commission, including disabled veterans or their wives, the widows of veterans, and the widowed or divorced mothers of veterans who lost their lives while in the Armed Forces or who were totally disabled while on active duty. A person who has been granted veteran preference by the Civil Service Commission receives extra points which are added to his passing grade in an examination. An honorably discharged war veteran gets 5 extra points. A person who is eligible for 10–point veteran preference gets 10 points added to his passing grade.

Some examinations are kept open indefinitely. For example, an examination for persons of college caliber—the Federal Service Entrance Examination—was opened by the Civil Service Commission in the fall of 1955 to fill entrance positions in a wide range of occupations and professions. This assembled, or written, examination is open continuously to all college graduates and seniors, or persons who can qualify through experience or a combination of education and experience. The Federal Service Entrance Examination is used to fill entrance or trainee positions in which the employee's potential for development is considered more important than his having special training for the work. Thus, a person who passes the examination may be considered for entrance-level professional, administrative, or technical positions in a variety of fields—not just positions in his special field of study or training.

In addition to the Federal Service Entrance Examination, other examinations are held for some highly technical positions such as engineer, chemist, physicist, and accountant and auditor. These examinations are announced separately by the Commission.

After examinations are rated, applicants are notified whether they have achieved eligible or ineligible ratings. The Civil Service Commission enters the names of eligible applicants on a list in the order of their scores. When a Federal agency requests names of applicants for a job vacancy, the Commission sends the agency the three names at the top of the appropriate list. The appointing officer in the requesting agency can select any of the top three available applicants. Names of those not selected by this agency are restored to the list for consideration in connection with other job openings.

Appointments to civil-service jobs are made without discrimination because of race, religion, or political affiliation. Civil-service employees can vote as they please, but they are prohibited from rendering certain political services and may not be forced to contribute to any political fund.

After a person is appointed to a Federal job through a civil-service competitive examination, he must complete a 3-year period of conditional service to acquire full career standing. Generally, his appointment is probationary during the first year and he can be dismissed if his work is not satisfactory within this period. After he has completed the 1-year probationary period, he has the same protections against dismissal as career employees. A career or career-conditional employee may be promoted, reassigned to another job in his agency, transferred to another agency, or reinstated without time limit after leaving the Federal service, without competing in examinations with the general public. He can be removed from the career service only for cause—such as inefficiency, misconduct, or insubordination—after adequate review to protect him against dismissal for arbitrary or capricious reasons.

Federal employees who demonstrate outstanding ability are encouraged to prepare for more responsible assignments. Although agencies tend to promote from within, they also seek workers elsewhere in the Federal service or outside the Federal service to obtain the best qualified person for each position.

Layoffs, or "reductions in force," are sometimes necessary in the Federal Government for such reasons as cuts in appropriations made by the Congress and decreases in work in certain fields. When a reduction in force occurs, *an employee may be either retained or separated by the agency affected depending on:* Whether he has career status, whether he is a veteran or nonveteran, how many years of service he has, and how well he has performed his duties. A career employee receives retention preference over career-conditional and temporary employees, and a veteran receives retention preference over nonveterans with the same type of appointment. A Federal employee who is separated in a reduction in force is entitled to unemployment compensation similar to that provided for employees in private industry. He is covered by the unemployment insurance system in the State in which he worked.

Earnings and Working Conditions

Federal civilian employees are paid under several pay systems, including the Classification Act, the Postal Field Service Compensation Act, the wage board pay system, and other miscellaneous acts or orders. About 44 percent of the full-time Federal employees were paid under the Classification Act in June 1955; 19 percent were paid under the Postal Pay Act; 32 percent were paid under the wage board pay system; and about 5 percent were paid under other pay systems.

Pay rates for employees under the Classification Act are set by the Congress and are nationwide in coverage. The median (average) annual salary for the 951,000 Federal employees in the continental United States paid under the Classification Act in 1955 was $3,925.

The Classification Act provides a pay scale called the General Schedule (GS) for employees in professional, administrative, technical and clerical jobs, and for employees such as guards and messengers. The jobs under the General Schedule are classified and arranged in pay grades according to difficulty of the duties, responsibilities, and knowledge, experience, or skill required for the work involved. The distribution of Federal employees by grades in the General Schedule as of July 1956, together with the entrance and maximum salary for each grade at that time, are listed in the following tabulation:

Distribution of Federal employees by grade level, June 30, 1956

General schedule grade	Employees		Salaries	
	Number	Percent	Entrance	Maximum
1	6, 549	0. 7	$2, 690	$3, 200
2	83, 032	8. 7	2, 960	3, 470
3	201, 137	21. 2	3, 175	3, 685
4	155, 085	16. 3	3, 415	3, 925
5	104, 288	11. 0	3, 670	4, 480
6	39, 746	4. 2	4, 080	4, 890
7	94, 833	10. 0	4, 525	5, 335
8	21, 117	2. 2	4, 970	5, 780
9	84, 241	8. 9	5, 440	6, 250
10	13, 765	1. 5	5, 915	6, 725
11	60, 805	6. 4	6, 390	7, 465
12	42, 807	4. 5	7, 570	8, 645
13	25, 974	2. 7	8, 990	10, 065
14	10, 860	1. 1	10, 320	11, 395
15	4, 988	. 5	11, 610	12, 690
16	651	. 1	12, 900	13, 760
17	293	(1)	13, 975	14, 835
18	106	(1)	16, 000	16, 000

[1] Less than 0.05 percent.
SOURCE: Federal Employment Statistics Bulletin, July 1956 (table 7, p. 8) U. S. Civil Service Commission.

Employees in all grades except GS–18 receive periodic "step" increases if their job performance is satisfactory. In each of the first 10 grades, the increases occur every 12 months until the maximum salary is reached. In grades GS–11 through GS–17, they occur every 18 months. Employees in grades GS–1 through GS–15 also get "longevity increases" if they continue to serve in the same grade after they have reached the maximum salary.

The number of employees in each pay grade differs, of course, from one occupation to another. These differences are illustrated in the following tabulation which shows the distribution of employees in three selected occupations. As shown in this tabulation, a vast majority of the clerk-typists in the Federal Government are in grades GS–2 and GS–3. The likelihood that a clerk-typist will receive a salary higher than that of grade GS–3 is very remote unless he can qualify for and be promoted to a position in another occupation that has a higher salary structure. The bulk of the secretaries are in grades GS–4 and GS–5. Only about 1 percent of the secretaries advance to grades higher than grade GS–7. In

sharp contrast to these occupations, electronic engineers are concentrated in grades GS–9, GS–11, and GS–12, and about 15 percent of them advance to salary levels higher than grade GS–12.

Grade distribution of full-time Federal Government employees in three selected occupations, August 31, 1954

General schedule grade	Clerk-typist		Secretary		Electronic engineer	
	Number	Percent	Number	Percent	Number	Percent
Total	83, 575	100. 00	23, 083	100. 00	5, 320	100. 00
1	1, 042	1. 25	2	. 01	---	---
2	25, 549	30. 57	18	. 08	---	---
3	56, 325	67. 39	1, 038	4. 50	---	---
4	177	. 21	8, 989	38. 94	---	---
5	18	. 02	9, 463	41. 00	108	2. 03
6	1	(1)	2, 451	10. 62	9	. 17
7	---	---	750	3. 25	309	5. 81
8	---	---	117	. 51	3	. 06
9	---	---	87	. 38	1, 194	22. 44
10	---	---	13	. 06	28	. 53
11	---	---	9	. 04	1, 631	30. 66
12	---	---	2	. 01	1, 243	23. 36
13	---	---	2	. 01	560	10. 53
14	---	---	---	---	180	3. 38
15	---	---	---	---	48	. 90
16	---	---	---	---	7	. 13
Not specified [2]	463	. 55	142	. 62	---	---

[1] Less than 0.01 percent.
[2] Includes positions in postal field service for which grades are not comparable.

NOTE.—Because of rounding, percents may not add to total.
SOURCE: Occupations of Federal White-Collar Workers, August 31, 1954, Pamphlet 56, 1955. U. S. Civil Service Commission.

New appointments to professional entrance-level positions such as those filled through the Federal Service Entrance Examination, described earlier in this chapter, are usually made at the entrance salary in grade GS–5. However, an eligible individual who holds a master's degree, or the equivalent in education or experience, may also be considered for a GS–7 position. Appointments to entrance-level positions requiring less than professional-level training are usually made in the grades below GS–5, the exact grade and corresponding salary depending on the difficulty and responsibilities of the position.

Although most new appointments are usually made at the entrance salary rate in the appropriate pay grade, the Civil Service Commission can authorize recruitment at rates above the usual entrance salary rate for hard-to-fill positions. For example, new employees were being recruited above the minimum rates in grades GS–5 and GS–7 for engineering and certain physical science jobs in 1956.

Employees are not promoted to a higher grade automatically. Promotions depend upon openings in higher grades and upon the ability and industry of the individual employee. Sometimes, however, it is not necessary for an employee to move to a new job to get a promotion. If his work assignments become more difficult and his responsibilities increase, his job may be reclassified to a higher grade with a corresponding inincrease in pay.

For the 432,000 postal service workers in the continental United States paid under the Postal Field Service Compensation Act in 1955, the median (average) annual salary was $4,314. Workers usually start as substitute clerk and move up to regular clerk when there is a job opening. Entrance pay was $1.82 an hour for substitute clerks in first- and second-class post offices and substitute carriers in the city delivery service. Substitute postal transportation clerks started at $1.92½ an hour.

About 609,000 skilled tradesmen and manual workers employed by the Federal Government in June 1955 were paid under the wage board system. The pay rates for these "blue-collar" workers are fixed by wage boards on the basis of "prevailing" rates paid for similar work by private employers in the areas where they work, rather than by legislation. The median annual pay of employees paid under this system was $4,139 in 1955. The reader may get an approximation of the wage level for a Government employee in a specific trade by referring to the area wage data included for that trade elsewhere in this Handbook.

About 54,000 Federal Government employees in the continental United States in 1955, were paid under acts or orders other than those discussed above. The median annual salary of these employees was $4,615. Among the employees paid under the miscellaneous pay acts or orders were those working for the Tennessee Valley Authority, the Foreign Service of the Department of State, and physicians, dentists, and nurses in the Bureau of Medicine and Surgery of the Veterans Administration.

The standard workweek for Federal Government employees is 40 hours and the pay schedules are based on this workweek. If an employee is

required to work more than 40 hours a week, he is either paid overtime rates for the additional time worked or he is given compensatory time off at a later date. Most employees usually work 8 hours a day, 5 days a week, Monday through Friday. However, the head of an agency may decide on a different schedule for his agency.

Federal employees receive paid vacations and sick leave. They earn 13 days of annual (vacation) leave during each of their first 3 years of service; then 20 days each year until they have completed 15 years of service; and after that, 26 days of leave each year. In addition, they earn 13 days of paid sick leave a year. Eight paid holidays are also observed annually. Employees who are members of military reserve organizations are granted up to 15 days of paid military leave for training purposes. Court leave with pay is granted to employees to attend court as a Government witness or for jury duty.

Other benefits available to most Federal employees include: A contributory retirement system providing retirement annuities based on salary, length of service, and either age or disability, along with survivorship annuities; optional participation in a low-cost group life insurance program supported in part by the Government; and compensation to employees injured in performance of duty.

Where To Go for More Information

Information on Federal employment opportunities is available from a number of sources. For college students, the college placement office is often a good source of such information. High school students in many localities may obtain information from their high school vocational guidance counselors. Additional information about Federal job opportunities and Civil Service competitive examinations may be obtained from the central and regional offices of the Civil Service Commission, State employment service offices, and post offices in many cities. The central office and regional offices of the U. S. Civil Service Commission are listed below along with the States included in each region.

Central Office—U. S. Civil Service Commission, Washington 25, D. C.

First Region—Post Office and Courthouse Building, Boston 9, Mass. (Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, and Connecticut.)

Second Region—Federal Building, New York 14, N. Y. (New York and New Jersey.)

Third Region—U. S. Customhouse, Second and Chestnut Sts., Philadelphia 6, Pa. (Pennsylvania, Delaware, Maryland, and Virginia.)

Fifth Region—Peachtree-Baker Building, 275 Peachtree St. NE., Atlanta 3, Ga. (North Carolina, South Carolina, Georgia, Florida, Tennessee, Alabama, Mississippi, Puerto Rico, and the Virgin Islands.)

Sixth Region—Post Office and Courthouse Building, Cincinnati 2, Ohio. (Ohio, Indiana, Kentucky, and West Virginia.)

Seventh Region—New Post Office Building, Chicago 7, Ill. (Michigan, Wisconsin, and Illinois.)

Eighth Region—1114 Commerce St., Dallas 2, Tex. (Arkansas, Oklahoma, Louisiana, and Texas.)

Ninth Region—New Federal Building, Twelfth and Market Sts., St. Louis 1, Mo. (Missouri, Kansas, Iowa, Nebraska, Minnesota, North Dakota, and South Dakota.)

Tenth Region—Building 41, Denver Federal Center, Denver, Colo. (Colorado, New Mexico, Utah, Wyoming, and Arizona.)

Eleventh Region—302 Federal Office Building, First Avenue and Madison St., Seattle 4, Wash. (Montana, Oregon, Idaho, Washington, and Alaska.)

Twelfth Region—128 Appraisers Building, 630 Sansome St., San Francisco 11, Calif. (California, Nevada, and Hawaii.

Armed Forces

All young men making their career plans must take into account their military service obligation. By knowing the choices open to them for the fulfillment of this obligation, they can better integrate military service with life careers and, in many cases, receive valuable vocational training while in the service.

In the present peace period, our Armed Forces are maintained through voluntary enlistment supplemented by a Selective Service System which drafts young men between the ages of 18½ and 26 in the number necessary to bring the total Armed Forces up to the desired level. A young man has the choice of enlisting in any one of a variety of programs involving different combinations of active service and reserve duty; or he may wait to be drafted for a 2-year period of active duty, followed by 4 years in the reserves.

These enlistment choices and the draft are subject, of course, to change at any time by Congressional action. The alternative choices described here in a general way serve only to illustrate a few

possibilities. Detailed up-to-date information can be obtained from local Armed Forces Recruiting Stations or from such publications as It's Your Choice and Your Life Plans and the Armed Forces. The former is available by writing to the following address:

It's Your Choice
Washington 25, D. C.

Your Life Plans and the Armed Forces is available at all high schools and colleges in the country.

The Reserve Forces Act of 1955 provided additional choices for fulfilling the military obligations. One of these important new choices allows a young man to fulfill his military obligation by enlisting in the reserves for 8 years, 6 months of which consist of active duty training. This enables him to complete his active military service in a 6-month period just after high school, before he enters college or starts a job.

If a young man wants to go directly to college he can remain in a deferred status by qualifying for student deferment or by enrolling in R. O. T. C. or certain other officer training programs. A young man who wants to enter an industry training program directly from high school may qualify for apprentice deferment and complete apprentice training before entering military service.

Since more than half of all enlisted jobs in the Armed Forces require training in a skilled trade, it is possible for a young man, during his military service, to receive training in electronics, aircraft maintenance, metal-working, or other skilled work which can be utilized later in civilian employment. To receive this kind of training, it is usually necessary to enlist for more than 2 years.

The Armed Forces also offer opportunity for lifetime careers in many of the fields discussed in this Handbook. General information on the occupations in the Army, Navy, Air Force, Marine Corps, and Coast Guard may be obtained from their respective recruiting stations. Career fields in the Navy, Air Force, and Army are listed in the following sections of this chapter together with further sources of information.

Navy

The occupational structure of the Navy is explained in the United States Navy Occupational Handbook, Bureau of Naval Personnel, Washington 25, D. C., 1956. This handbook contains 61 vocational information briefs on Navy occupations classified into 12 major groups. Each brief explains the purpose of the job, duties and responsibilities, work assignment, qualifications and preparation, training given, paths of advancement, and related naval or civilian jobs. Promotions, pay rates, retirement provisions, and other aspects of careers in the Navy are explained in the introduction. There are additional briefs included in the handbook on women in the Navy, commissioned officers, the Naval Reserve, and the Submarine Service. This publication is available in all high schools, colleges, public libraries, State employment service offices, and Navy recruiting stations. The Navy career fields are as follows:

Boatswain's mate
Quartermaster
Radarman
Sonarman
Torpedoman's mate
Mineman
Gunner's mate
Fire control technician
Guided missileman
Electronics technician
Instrumentman
Opticalman
Teleman
Radioman
Communications technician
Yeoman
Personnel man
Machine accountant
Storekeeper
Disbursing clerk
Commissaryman
Ship's serviceman
Journalist
Lithographer
Draftsman
Musician
Machinist's mate
Engineman
Machinery repairman
Boilerman
Electrician's mate
Interior communications electrician
Metalsmith
Pipefitter
Damage controlman
Patternmaker
Molder
Surveyor
Construction electrician's mate
Driver
Mechanic
Builder
Steelworker
Utilities man
Aviation machinist's mate
Aviation electronics technician
Aviation guided missileman
Aviation ordnanceman
Aviation fire control technician
Air controlman
Aviation boatswain's mate
Aviation electrician's mate
Aviation structural mechanic
Parachute rigger
Aerographer's mate
Tradesman (training devices)
Aviation storekeeper
Photographer's mate
Hospital corpsman
Dental technician
Steward

Air Force

The Air Force has published a manual for vocational guidance counselors and Air Force person-

nel officers called the Occupational Handbook of the United States Air Force, Headquarters, U. S. Air Force, The Pentagon, Washington 25, D. C., 1956. This handbook contains briefs on each of the 43 airmen career fields. Each brief includes a statement of the scope of the particular career field and an organizational chart which shows the relationship between the various jobs and indicates the paths of advancement. For the various jobs in a career field, the brief gives a description of duties and responsibilities, qualifications and preparation, training given, and related civilian jobs. The handbook also has special sections on pay rates, opportunities for a commission, women in the Air Force, and reserve components. In addition, there is a valuable school subject index to airmen career fields. This publication is available in all high schools, State employment service offices, Air Force recruiting stations, and Air Force bases. The following are the airmen career fields:

- Intelligence
- Photomapping
- Photographic
- Weather
- Air traffic control and warning
- Communications operations
- Radio and radar systems
- Guided missile systems
- Armament system maintenance
- Atomic weapons
- Training devices
- Wire maintenance
- Intricate equipment maintenance.
- Aircraft accessories maintenance
- Aircraft and engine maintenance
- Rocket propulsion
- Production control
- Munitions and weapons maintenance
- Motorized and misc. equipment maintenance
- Metalworking
- Construction
- Utilities
- Firefighting
- Fabric, leather, and rubber
- Marine
- Transportation
- Food service
- Supply
- Procurement
- Finance, accounting, and auditing
- Statistical analysis and machine accounting
- Administrative
- Printing
- Information
- Personnel
- Special services
- Education and training
- Band
- Air police
- Special investigations
- Medical
- Aircrew protection
- Dental

Army

The Army has divided its occupations into 30 career fields which are explained in the United States Army Occupational Handbook, Office of the Adjutant General, Department of the Army, Washington 25, D. C., 1952. Briefs on the career fields describe job organization, duties and responsibilities, work environment, qualifications, training given, advancement, and related civilian jobs. Each brief contains a job progression chart showing normal lines of advancement and indicating areas of work involved in the particular career field. The handbook contains additional sections on requirements for enlistment, pay scale and allowances, educational opportunities in the Army, opportunities for commissioned and warrant officers, opportunities for women in the Army, aptitude areas, and an index to related civilian jobs. The handbook is available in all high schools and Army recruiting stations. Information on every job in each career field is given in greater detail in the Manual of Enlisted Military Occupational Specialties, AR 611–201, March 1955. Although intended for military use, this book is useful to civilians as well, because of its thorough examination of each job specialty. The manual is available at all Army recruiting stations, posts, and installations. The 30 Army career fields are as follows:

- Infantry
- Armored
- Artillery
- Military intelligence
- Machine accounting
- Personnel and administration
- Special services
- Chemical
- Engineering and construction
- Engineer and equipment maintenance
- Mapping and reproduction
- Finance
- Information
- Ammunition
- Armament maintenance
- Army aircraft maintenance
- Automotive maintenance
- Military police
- Food service
- Quartermaster maintenance
- Supply
- Wire maintenance
- Communications
- Electronics maintenance
- Photography
- Medical
- Scientific services
- Marine operations
- Motor transport
- Railway

State and Local Government

The 5 million jobs in State and local government agencies are even more widely distributed throughout the country than Federal Government jobs. About one-quarter of them are in State Government agencies; the balance are in city and county governments, school districts, and other local agencies.

Education is the activity in which the greatest number of State and local government employees are engaged; 43 percent of all State and local

overnment employees are in this field. In addition to teachers, school systems employ administrative people, librarians, clerical, and maintenance workers. About 9 percent of State and local government employees are in highway work, including civil engineers, surveyors, and highway maintenance workers. Another 9 percent work in hospitals, in nearly all the occupations listed in the chapter on Health Service Occupations. More than a quarter million people are engaged in police work. Other State and local employees are engaged in a wide variety of other activities requiring many different types of skills as shown in the following tabulation:

Employment in State and local governments, by type of government and function, October 1955

[In thousands]

Function	Total	State	Local
Total	5, 054	1, 250	3, 804
Education	2, 169	384	1, 784
Public schools	1, 815	53	1, 762
Institutions of higher education	330	308	22
Other	23	23	------
Highways	475	199	276
Hospitals	446	230	216
General control	420	72	349
Police	273	24	249
Local utilities (water, electricity, transit, and gas)	228	------	228
Fire protection	180	------	180
Natural resources	126	97	29
Sanitation	120	------	120
Public welfare	105	43	63
Health	73	26	47
Local parks and recreation	69	------	69
Employment security administration	45	45	------
Housing and community redevelopment	25	------	25
State liquor stores	14	14	------
Nonhighway transportation	13	4	9
All other	273	113	160

NOTE.—Figures do not always add to totals because of rounding.

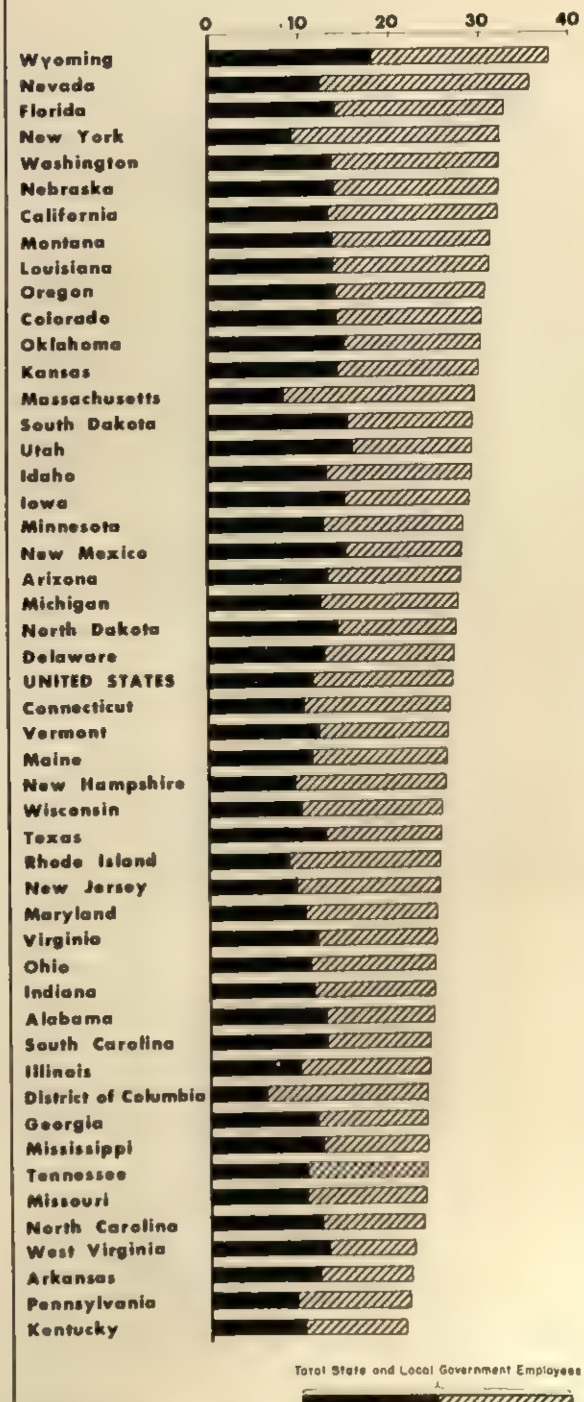
SOURCE: State Distribution of Public Employment in 1955, G-GE55-No. 2 U. S. Department of Commerce, Bureau of the Census.

State and local government employment opportunities are distributed among the States roughly in proportion to their population, but some States have relatively more of such employees than

CHART 70

STATE AND LOCAL GOVERNMENT EMPLOYEES PER 1,000 INHABITANTS, OCTOBER 1955

(Full-Time Equivalent)



UNITED STATES DEPARTMENT OF LABOR
BUREAU OF LABOR STATISTICS

Source: U S Bureau of the Census

others. Chart 70 shows, for each State and the District of Columbia, the number of employees per 1,000 inhabitants (with part-time employees converted to full-time equivalents to make the data comparable from State to State).

Earnings

Earnings of State and local government employees depend first of all, of course, on their occupations. Information on salary rates paid for any specific occupation can be obtained from the appropriate agencies in each State or locality. Average monthly earnings of full time State and local employees in each State in October 1955 are shown in the following tabulation:

State average monthly earnings

United States	$316	Maryland	$313
Alabama	259	Massachusetts	315
Alaska	----	Michigan	364
Arizona	325	Minnesota	327
Arkansas	217	Mississippi	209
California	394	Missouri	272
Colorado	293	Montana	315
Connecticut	345	Nebraska	279
Delaware	310	Nevada	352
District of Columbia	394	New Hampshire	262
Florida	275	New Jersey	349
Georgia	232	New Mexico	318
Idaho	276	New York	359
Illinois	360	North Carolina	273
Indiana	309	North Dakota	295
Iowa	282	Ohio	317
Kansas	276	Oklahoma	268
Kentucky	244	Oregon	329
Louisiana	259	Pennsylvania	311
Maine	252	Rhode Island	291
South Carolina	$220	Virginia	$260
South Dakota	256	Washington	344
Tennessee	253	West Virginia	271
Texas	284	Wisconsin	333
Utah	296	Wyoming	300
Vermont	260		

SOURCE: Bureau of the Census, Government Employment: 1955, State Distribution of Public Employment in 1955, G–GE55–No. 2.

In comparing the averages from State to State, one must remember that they are affected somewhat by the different proportions of various occupations included. Nevertheless, there is wide variation among the States; the highest average pay is nearly twice the lowest average. Differences in earnings levels reflect differences among the States in wage rates generally. The range in October 1955 was from an average of $209 a month for full-time State and local government employees in Mississippi to $394 in California, with a median of $316 for all the States.

Where To Go for More Information

People interested in working for State or local government agencies should inquire about salary rates, job openings, how to apply for employment, and other information from the appropriate agencies in each State, county, or city. School and college counselors or placement offices, local offices of State employment services, and other community agencies which provide counseling services will also have information, or can tell applicants where to get it.

Index I—Occupations Classified by Broad Fields of Work

The Dictionary of Occupational Titles prepared by the U. S. Employment Service classifies occupations in two different ways. The first classification system divides occupations into seven major groups, which in turn are divided into smaller groups. To indicate how the occupations discussed in the Handbook fit into this classification, D. O. T. numbers are given in the occupational reports following the titles of the occupations discussed. The first digits of these numbers show the major occupational groups in which the given occupations are classified, as follows:

0 Professional and managerial occupations:

0–0 through 0–3	Professional occupations
0–4 through 0–6	Semiprofessional occupations
0–7 through 0–9	Managerial and official occupations

1 Clerical and sales occupations:

1–0 through 1–4	Clerical and kindred occupations
1–5 through 1–9	Sales and kindred occupations

2 Service occupations:

2–0	Domestic service occupations
2–2 through 2–5	Personal service occupations
2–6	Protective service occupations
2–8 through 2–9	Building service workers and porters

3 Agricultural, fishery, forestry, and kindred occupations:

3–0 through 3–4	Agricultural, horticultural, and kindred occupations
3–8	Fishery occupations
3–9	Forestry (except logging), and hunting and trapping occupations

4, 5 Skilled occupations

6, 7 Semiskilled occupations

8, 9 Unskilled occupations

As an aid in the counseling and placement of young workers, the U. S. Employment Service also devised an Entry Occupation Classification Structure, published as Part IV of the Dictionary of Occupational Titles. This classifies fields of work, such as musical work, literary work, graphic art work, metal machining, mechanical repairing, or machine tending—rather than specific occupations. However, occupations related to each field of work are also shown.

In the following index, the occupations discussed in this Handbook are grouped according to the fields of work listed in Part IV of the Dictionary. By use of this index, information on occupations related to fields of work of interest to different individuals can be located readily. For example, a person interested in "artistic work" will find references under that heading to the reports on commercial artists and interior decorators; and one interested in "mechanical repairing" will find references to many sections, including those on business-machine servicemen, automobile mechanics, and millwrights.

(Guide to occupations described in the Handbook through entry occupational classifications; Part IV of Dictionary of Occupational Titles)

0–X Professional, Technical, and Managerial Work—Continued

0–X3 Literary Work—Continued

0–X4 Entertainment Work

0–X6 Public Service Work

0–X7 Technical Work

0–X7 Technical Work—Continued

0–X7 Technical Work—Continued

4–X Mechanical Work—Continued

4–X2 Machine Trades—Continued

4–X2 Machine Trades—Continued

4–X6 Crafts

4–X Mechanical Work—Continued

4–X6 Crafts—Continued

4–X6 Crafts—Continued

6–X Manual Work

6–X2 Observation Work

6–X Manual Work—Continued

6–X4 Manipulative—Continued

6–X6 Elemental Work

6–X6 Elemental Work—Continued

Index II—Alphabetical Index to Occupations

Other Publications Useful to Counselors

The occupational outlook publications issued by the United States Department of Labor's Bureau of Labor Statistics for use in vocational counseling include several types of reports besides the Occupational Outlook Handbook. These other publications, which are designed to provide a continuous flow of up-to-date information on employment outlook or to supplement the Handbook in other respects, are as follows:

THE OCCUPATIONAL OUTLOOK: Published 4 times during each school year, to keep readers current on developments affecting employment trends and outlook between editions of the Handbook. Presents the results of new occupational outlook studies by the Bureau of Labor Statistics. Also reports on projects and studies of special interest to counselors conducted by other bureaus of the Department of Labor and other Government agencies. Subscription price $1 a year ($1.25 foreign). Single copies, 30 cents each. May be ordered by using form on page 697.

REPRINTS FROM OCCUPATIONAL OUTLOOK HANDBOOK: For use by persons interested in particular occupations or industries and by counselors and librarians who keep occupational information materials in a vertical or subject file. Reprints of all reports on industries and on individual occupations or groups of related occupations are available. A list of the reprints, with prices, is contained in latest List of Occupational Outlook Publications (which may be obtained by using form on page 696.

OCCUPATIONAL OUTLOOK SUMMARIES AND WALL CHARTS: Sent free of charge to all schools and organizations on occupational outlook mailing list. Summaries briefly describe conclusions of new outlook studies. Wall charts, suitable for bulletin board or classroom display, graphically emphasize the essential facts about various occupations and industries. Available summaries and wall charts are listed in latest List of Occupational Outlook Publications. Form on page 696 may be used to request this list and to have name placed on mailing list.

OCCUPATIONAL OUTLOOK BULLETINS AND SPECIAL REPORTS: Bulletins contain detailed information on employment outlook, earnings, working conditions, promotional opportunities, and training requirements in major occupations and industries. Special reports discuss such related subjects as occupational mobility, patterns of working life, and employment and economic status of various groups in the population. These bulletins and reports, which are issued at irregular intervals, are listed in latest List of Occupational Outlook Publications.

OCCUPATIONS AND INDUSTRIES REGIONAL SERIES: Pamphlets giving information on numbers of jobs and past trends in employment in specific occupations and industries in each Region, State, and metropolitan area. Include charts and

tables. Published by the Veterans Administration in 1955. May be ordered by using the form on page 697.

Title	*VA Pamphlet No.*	*Price (cents)*
Occupations and Industries in the—		
New England States	7–7.1	55
Middle Atlantic States	7–7.2	50
East North Central States	7–7.3	60
West North Central States	7–7.4	60
South Atlantic States	7–7.5	65
East South Central States	7–7.6	40
West South Central States	7–7.7	50
Mountain States	7–7.8	50
Pacific States	7–7.9	40

Current information on employment and earnings in different parts of the country can be obtained from two other Bureau of Labor Statistics publications:

EMPLOYMENT AND EARNINGS: Monthly magazine giving employment statistics for industries in each State and metropolitan area, as well as national figures on employment, earnings, hours of work, and labor turnover in different industries. Subscription price $3.50 a year ($1 additional for foreign mailing). May be ordered by using form on page 697.

OCCUPATIONAL WAGE SURVEYS: Give figures on average earnings and employment in selected occupations and major industries and labor-market areas. Also give weekly working hours for some groups of workers and show prevailing local practices in regard to supplementary benefits such as pensions, vacations, holidays, and sick leave. List of available Occupational Wage Surveys may be obtained by using form on page 696.

Request Form

U. S. Department of Labor,
Bureau of Labor Statistics,
Washington 25, D. C.

☐ Place my name on the mailing list for Occupational Outlook Summaries and Wall Charts

(NOTE.—If you receive mail with the number 136 below your address, your name is already on this mailing list.)

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